Understanding Enterprise Architecture in Four UK Universities

A thesis submission in partial fulfillment of the requirements of the University of Bolton for the degree of Doctor of Philosophy

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March 2011

ACKNOWLEDGMENT

Thanks to my family especially my mum, sister and husband, for all your love and encouragement. I also thank my supervisor, colleagues and friends for making this a worthwhile adventure!

ABSTRACT

This research examines the rationale and impact of Enterprise Architecture (EA) adoption in the UK Higher Educational (HE) sector. EA supports alignment of Information Systems (IS) capability and high-level Strategic Planning for organisations. Previous studies in HE sector show that IS planning difficulties are increasingly affecting required levels of effectiveness and future changes. Institutions identify the need for a business-like approach, to support senior managers in the decision-making in times of unprecedented economic and sector revolution. Adopters spearheading the process claim that EA concepts and tools will enable institutions capture IT resources, align administrative processes, leverage IS investments and coordinate information requirements and regulations effectively. This claim is supported by the identification of benefits of EA in other public and private sectors. Using 4 UK universities, this study reviews the practices and effects of EA in the larger but more traditional universities and medium-sized but newer universities. The institutions were investigated using interpretive research methods. Data was collected through semi-structured interviews and thematic analysis was used to analyse the data and interpret the findings based on a combination of existing and new theoretical constructs. A summary of the research findings states four key success factors for the adoption and institutionalisation of EA in HE institutions. They are: *(i) Senior management support, appropriate organisational structures, actors and scope of EA work (ii) Key stakeholder buy-in and commitment (iii) Resources (iv) Evaluation metrics.* HE institutions are not adverse to EA adoption; but are aware that institutional actors and cultures shape the adoption. There are necessary support structures that should be in place: *(i) institutions need to have a formalised governance structure, which ensures proper planning procedures are enforced and change is monitored effectively, (ii) the right people skill and availability would ensure success, (iii) adopting a systematic and continuous approach to business process review (iv) institutions need to develop simple and flexible IT infrastructure to enable requirements for integration, accessibility, and agility.*

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List of Abbreviations

ADM - Architectural Development Methodology

CC - Connected Campus

CeRch - Centre for Research

CIO - Chief Information Officer

CSF - Critical Success Factor

CS - Case Study

DOI - Diffusion of Innovation

DEEWR - Employment and Workplace Relations

EA - Enterprise Architecture

EAPG - Enterprise Architecture Practice Group

EARF - Enterprise Architecture Research Forum

EIA - Enterprise Information Architecture

EAI - Enterprise Architecture Integration

EPFL-ECOLE - École Polytechnique Fédérale de Lausanne

EFQM - European Foundation for Quality and Management

FE - Further Education

FEAF - Federal Enterprise Architecture Framework

FEAR - Finnish Enterprise Architecture Research

FSD - Flexible Service Delivery

GERAM - Generalised Enterprise Reference Architecture and Methodology

HE - Higher Education

HEAR - Higher Education Achievement Record

HILDA - High Level Domain Architecture

IS - Information Systems

IS&T - Information Systems & Technology

IT - Information Technology

ITRI - IT Research Institute

JEA - Journal of Enterprise Architecture

JISC - Joint Information Systems Committee

KEAP - Kings' Enterprise Architecture Project

LEAP - Liverpool Enterprise Architecture Project

LJMU - Liverpool John Moores University

MIT-CISR - MIT Sloan School of Management - Center for Information Systems Research

MUSIC - Measuring and Understanding the Systems Integration Challenge Projects

MWE - Modern Working Environment

NEA - National Enterprise Architecture

NZ-MOE - New Zealand Ministry of Education

PA - Public Administration

PIB - Project Implementation

QR - Qualitative Research

ROI - Return On Investment

SEAM - Systemic EA Methodology

SOA - Service Oriented Architecture

TEAR - Trends in Enterprise Architecture Research

TOGAF - The Open Group Enterprise Architecture Framework

UML - Unified Modelling Language

UK - United Kingdom

UCISA - Universities and Colleges Information Systems Association

VC - Vice Chancellor

VCO - Vice Chancellor's Office

VRE - Virtual Research Environment

ZF - Zachman Framework

CHAPTER ONE: RESEARCH INTRODUCTION

1.0. INTRODUCTION AND RESEARCH BACKGROUND

Chapter One provides the structure of this research outlining some background information about EA as a discipline and a practice. The researcher explains the research framework adopted for this study and outlines the research question, aims and objectives of the study. The research strategy and thesis structure are also discussed.

There are several definitions of Enterprise Architecture (EA), but the adopted definition for this study states that, *"EA is a coherent whole of principles, methods, and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure"* (Lankhorst et al. 2005, p.3). This definition is used by the United Kingdom (UK) Higher Education (HE) Enterprise Architecture (EA) community, hence the adoption for this study. In other EA communities, it is described as, *"a 'representation' of essential elements comprising a socio-technical organisation, and relationships with each other and their external environment"* (Harmen et al. 2007). The Open Group describes EA as, *"a design product that shows the coherence between business products, processes, organisational structure, people, information, and IT infrastructure"* (The Open Group, 2006). The Open Group is a vendor and technology-neutral consortium that has worked with major technology and consulting organisations. The Open Group develops standards that both private and public sector organisations adopt. The standard framework for EA is widely adopted and not confined a single organisational structure. The Open Group Enterprise Architecture Framework is used extensively in the initial work of EA adoption in UK universities. In other words, EA provides a comprehensive view of the structure of the organisation, operations and resources that are interrelated to fulfil the business strategy or as a '*process*' to understand complexity and manage change, such as, coordinating projects, resources and the development of the enterprise architectures. EA is still a relatively young practice, about 20 years old compared to other Information Systems (IS) planning practices that are in existence for over 100 years. Current research in the IS discipline suggest that although EA is yet aspiring; it is well accepted within the IS discipline as practice for business and IT alignment

(Bucher et al. 2006; Schelp & Stutz, 2007; Van der Raadt et al. 2007; Van Steenbergen & Brinkkemper, 2008; Hjort-Madsen, 2009). Other studies propose that it is still very immature (Langenberg & Wegmann, 2004), and with still very confusing and non-standardised concepts (Wagter et al. 2005). EA research dates back to 1980, which gives some credibility to the practice as *'mature and influential'* across many organisations (Boucharas et al. 2010). There are other issues that surround the phenomenon, such as, its deficiency in substantial theoretical foundations and complexity of stakeholder requirements (Wegmann, 2003), lacks consistency across users (Bommel et al. 2007), and more recently, lacks a universal definition (Stelzer, 2009). The recognition the EA under the Information System's planning discipline began the 1980s. As a trainee for one of IBM's Director of Architecture for business systems planning, John Zachman suggested the use of a preset structure, a blueprint or architecture towards understanding the organisation's technology topography and ensuring design changes are aligned with the wider business strategy. The structure was thus, designed to reduce what he described as the *'chaos effect'* and further disintegration of the organisation. The model he used became the first *'Framework for Information Systems,'* for classifying descriptive representations of an enterprise system (Zachman, 1987). Today, the framework have been modified several times into what is known as the *'Zachman Framework'* (Zachman & Sowa, 1992). The framework is used to define the components that are constitutes of an enterprise system. These components are described as *'abstractions of the enterprise.'* They are classified as; the artifacts or products within the enterprise (*the what)*, the processes for input and output (*the how*), what locations these processes and activities occur (*the where*), the people roles and responsibilities (*the who*), the time of event and occurrences (*the when*) and (the motivation, goal, strategies supporting these activities (*the why*). As businesses evolve, existing IT platforms increase, and need to be updated regularly and need to be realigned as the business goals change. Organisations often end up with redundant systems that are expensive to replace or discard. The adoption of an enterprise-wide design using architectural concepts may help to resolve such types of complexities in a rather effective systematic manner. Such practices have become common and useful, to create more agility for the organisation. System complexities is known to result in issues such as, poor business alignment with IT, lack of clear IT vision as perceived by management, lack of value creation from IT investment and poor of project vision (Zachman, 1987; Nolan & Mulryan, 1987; Zachman & Sowa, 1992). Zachman's

vision for use of the framework is that, businesses can achieve value and agility by adopting a holistic approach to manage the IS architecture (Zachman, 1987). The framework helps to create a vision of the *'current* and *future state'* of the enterprise. Some users describe the Zachman framework to be more useful as a logical structure or taxonomy. The taxonomy can be used to classify and represent the enterprise (Pereira & Sousa, 2004). In 1996, the United States (US) Federal Government enacted the Clinger-Cohen Act to support reforms, acquisition and IT management in Federal Government agencies. Further on, the Office of Management and Budget enacted the Electronic Government Act, to improve IT performance, eliminate waste and reduce costs of administration. This birthed the e-government initiative and the development of the Federal Enterprise Architecture Framework (FEAF). The framework is adopted by public sector organisations, to align information systems with business goals to eliminate waste and improve citizens' services (Langenberg & Wegmann, 2004). The framework helps organisations to addresses issues such as, data integration and standardisation of the systems infrastructure (Ross et al. 2006). The responsibility to control the integration of information systems components in the organisation by understanding roles, rules and behaviours lies with the Chief Information Officers (CIO). The use of architectural concepts has also become a common planning and decision-making practice in many large private sector organisations. Today, *Enterprise Architecture* is the term used to describe this architectural concept and practice. As a discipline, EA focusses on engineering and transformation of the enterprise by establishing normative behaviours for system designs and structures for controls (Dietz & Hoogervorst, 2008; Chen et al. 2008). It is adopted across many other organisations including manufacturing, finance, logistics, and the healthcare sector (Janssen & Kuk, 2006; Susarapu & Baker, 2007; Janssen & Hjort-Madsen, 2007; Hjort-Madsen & Pries-Heje, 2009; Iyamu, 2009). Research conducted by independent organisations such as, Ovum Group, Forrester, Gartner and Infosys show that EA had become more established across several sectors, both small and large organisations, and is used as an enabler for business and IT alignment (Aziz et al. 2005). Applications of EA also include the need to establish a better and informed governance structure within an organisation (Op't Land et al. 2009). An organisation's governance structure informs and guides overall business decisions, while IT governance capability within an organisation that is a subset of the overall organisational governance structure. The IT governance structure is the supporting component for successful business development and fulfillment because it

drives the use of technology resources and capabilities. The IT governance structure ensures that suitable IT decisions and investments are prioritised to support the business strategy and development. An IT governance framework can be integrated with an EA framework to ensure constrain in business change requirements. EA concepts help to maintain such constrains, while ensuring business decisions are effective.

1.1. RESEARCH SETTING

There are many IT units within an institution, which may substantially impede the ability to integrate or consolidate with things like a data warehouse, standard IT platforms or a central IT department. These activities result in interoperability and communication issues, which reduce the possibilities for sharing services or reuse. The introduction of EA in UK HE institutions, which began in 2008, has brought an awareness of the potential in reusing and managing IT resources more effectively. From previous research, a potential issue with the adoption of EA in the UK HE sector will include the origin and definition of EA. HE institutions are rarely considered as *'enterprises'* profit making enterprises. These factors would be predictive in influencing the acceptance EA would receive in the sector. Similar adoption of EA in Higher Education is subsequently low, with EA's introduction to education sector lagging five years behind the private sector organisations (Birnbaum, 2008). There are reported adoption in some Australian, Canadian and American Universities. Active participation has been led by EDUCAUSE and ITANA in the United States HE sector. Transformation in the education sector has always been more about pedagogies than changes to IT or control systems. Thus, the adoption of EA may not be fully supported in this domain or considered high priority compared to other private sector organisations that are more profit-oriented.

HE organisational structures can be grouped into three categories: *(i) Bureacratic or collegial* (Hoyle, 1989) akin to large institutions, such as the pre-92 institutions; *(ii) Restricted collegiality* (Bush, 2003); *(iii) Solid corporation and flexible enterprise* (McNay, 1995) akin to post-92 and newer universities. The organisational structure largely describes intrinsic institutional values, ethics and priorities. There are obvious internal variations across different levels of the institution. For example, an institution may exhibit a high level of bureaucracy in its central administrative processes, but adopt a collegial attitude to its academic management structure. The roles and

responsibilities adopted in these institutions can also vary from a traditional Provost or a Vice Chancellor undertaking the responsibility of a Chief Executive Officer, or the role of the Director of Finance and the Chief Exchequer undertaking the responsibility of an administrative adviser. In recent times, there has been an increased need for change, a greater level of institutional efficiency, better IT planning and management. The HE sector's strategic use of IT resources can be categorised in three aspects, namely, *(i) Lack of use of IT resources for institutional transformation; (ii) Minimal use of IT resources as strategic enablers; (iii) Much use of IT resources as operational enablers.* In any traditional institutional setting, yearly institutional planning, goal setting and strategic IS planning are two separate events. The former is conducted by senior management, while, the IS planning is set by the Head of IT, more independently. Today, organisations acknowledge the disparities arising from these independent decision making activities. Theoretically, IS researchers also identify the lack of a technique that addresses collaboration between business and IS planning alignment. Albrecht et al. (2004) suggest that an HE institution finds it difficult to enforce systems alignment because of its distinctive organisational structure. In 1997, it was proposed that an IS strategy should be a part of the high-level organisational strategy (Teo & King, 1997) and is still a requirement today for HE institutions that IS planning should be a *top down* approach or driven by senior management (Dearing Report, 1998, Lambert Report, 2003). A recent industry survey reported that IT alignment is one of the top five issues senior management wants to resolve. The Universities and Colleges Information Systems Association (UCISA) executive summary for 2001 also suggested the growing need for IT alignment with institutional strategy (UCISA Report, 2008). Effective IT planning, good governance, dialogues between the business and IT, precedes successful alignment of IT investments and resources with the overall institutional strategies (Albrecht et al. 2004). EA provides that technique to for collaboration between business and IT (Colleen, 2001). The EA as a technique provides institutions with the ability to understand both internal and external processes, actors, technologies and the ability to adapt to changes and new business requirements. It brings order and structure to understanding the organisation (Inmon et al. 1997). It helps for making better business decisions. Senior management and key stakeholders are able to understand the impact of change and discern measures for effective change management.

1.2. RESEARCH FRAMEWORK

Figure 1.1 shows the major components of this study. Two main sources of institutional theory reviews practices of business and IS planning, and a potential direction for research. The framework highlights four main issues that describe main issues surrounding IT usage in HE institutions. These issues also represent the fundamental problems of business and IT alignment in research.

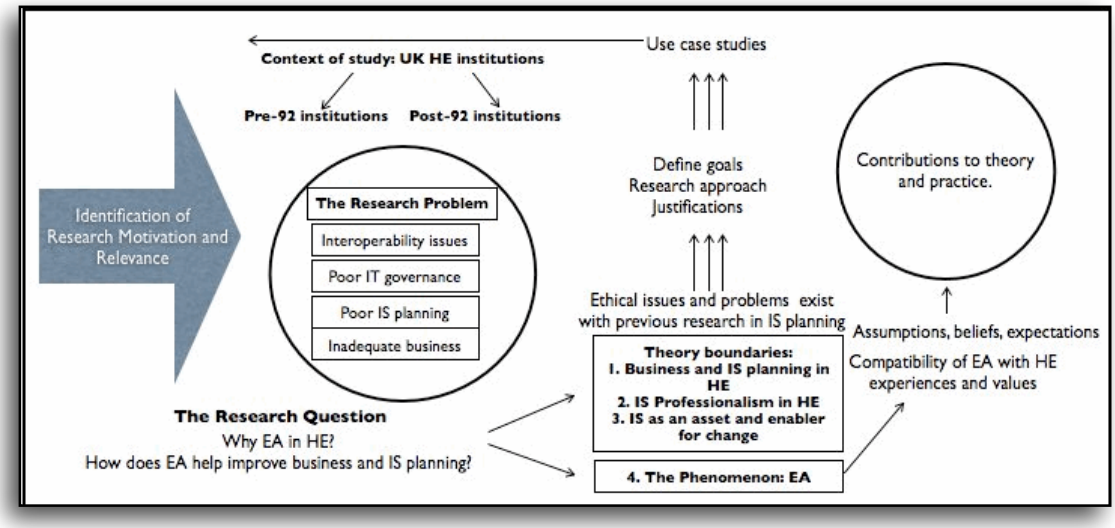

FIGURE 1.1. RESEARCH FRAMEWORK.

1.3. MOTIVATION OF STUDY

An IS strategy is a plan for the development and use of information and technology resources, to support the realisation of a vision in the organisation (Wilson, 1989). The design of an integrated IS strategy is one of the main challenges facing IS managers (Dearing Report, 1997). HE institutions need to design better-integrated information systems strategies that align with wider institutional goals and support new government policies. This enables the smooth flow of information between infrastructural resources and help better security measures to be maintained (Cooke, 2008). These changes provide institutions with opportunities to review existing strategies, which will consequently ensure exploitation of new market opportunities. Also, using an EA practice to ensure effective IT governance will help in corroborating with the different silos groups within the institution. EA provides a coherent resource-base that ensures the establishment of business capabilities, to

respond to business demands. The primary motivation thus, for this study is, to investigate the suitability of EA concepts in addressing some of these issues. Also, the researcher's personal motivation for this study originates from a job obligation, which includes supporting interested HE institutions in using EA. The realisation that there are already issues institutions struggle with, such as the lack appropriate EA tools for institutions, personnel resource and skill requirement for the EA work.

1.4. RESEARCH QUESTION

An overarching research question that will guide this study states: ***Does Enterprise Architecture help administrative reforms in the HE sector and have they found the panacea for IS effectiveness and efficiency?*** This study seeks to understand the institutional uptake and institutionalisation of EA in the UK HE sector using four institutions. The adoption of EA may provide a technique that situates IS resources as strategic enablers for the overall institutional goal. This research will investigate key surrounding issues, such as, *"What does EA mean to the various institutions? What role does EA play in improving IS effectiveness and efficiency? What significant value does EA bring to these institutions? Is EA seen as the crucial link between the administrative transformation, institutional strategy and the supporting role of IS? Are there EA tools that are more suited for use in HE institutions?* There are other factors that influence the success of such adoption of innovation, such as, political agenda (Keen, 1981) and organisational culture (Mintzberg, 1994). This research will investigate the existence of such issues and understand how they affect these institutions.

1.5. RESEARCH QUESTIONS AND OBJECTIVES

The following section identifies three sub research questions and the objectives set out in this study:

Research Question 1: Why is EA adopted in HE institutions?

Objective: To review of existing EA research and identify the drivers for the adoption in the UK HE sector.

Research Question 2: How is EA adopted in HE institutions?

Objective: To review the uptake of EA using the JISC EA pilot programme as the unit of analysis.

Research Question 3: What is the impact of EA adoption in HE institutions?*Objective: To identify factors affecting the adoption using Rogers' and Birnbaum's theory with modifications, where necessary, and develop a framework to evaluate the adoption.*

1.6. RESEARCH STRATEGY

Figure 1.2 represents the research strategy adopted for the study. The strategy identifies the research problem and builds on theories from existing work bounding the study and add new findings as contributions to the IS discipline.

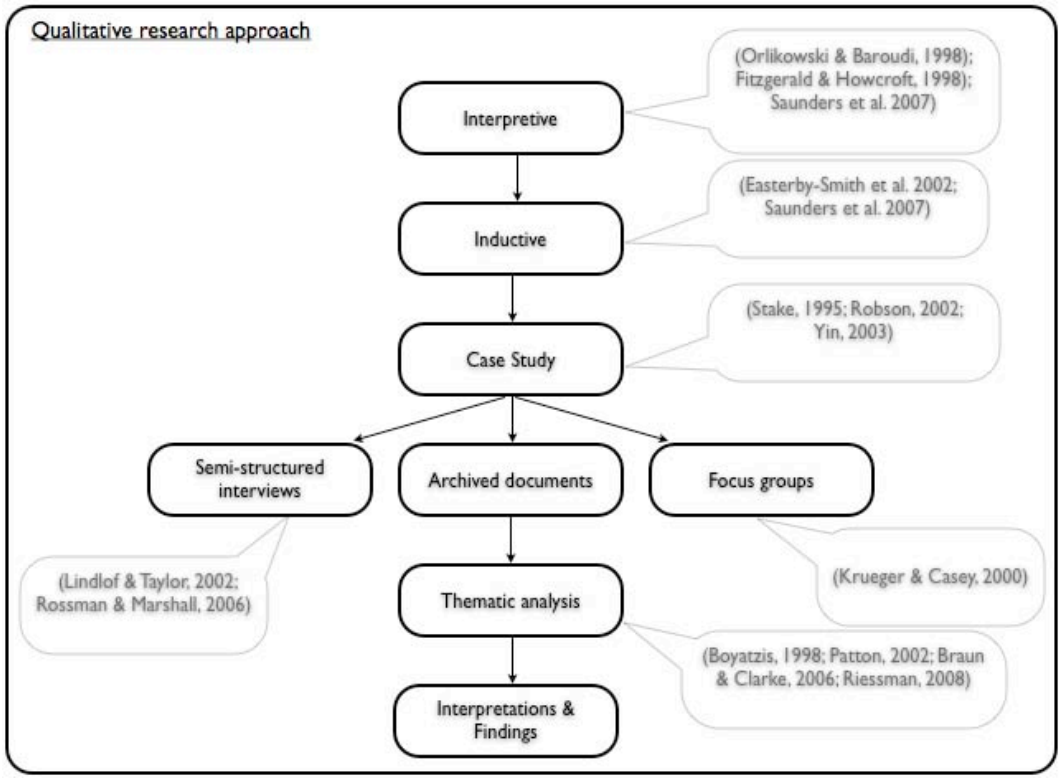

FIGURE 1.2. RESEARCH STRATEGY.

1.7. APPLICABILITY OF RESEARCH OUTCOMES

The intended framework development is aimed at evaluating and understanding the adoption of EA in the larger HE community. The framework could be adopted by both academic researchers and industry practitioners and substantially contribute to

future development of empirical studies of EA. The framework could be used to benchmark EA adoption and determine its maturity in other sectors, or be used to enhance further understanding of EA techniques in IS planning.

1.8. THESIS STRUCTURE

The following is a summary description of the structure of the thesis. Each chapter provides an introduction preceding the chapter and subsequent work.

1.8.1. CHAPTER ONE: INTRODUCTION

Chapter One provides an introduction to the study context by providing theoretical foundations of the study that sets the scene. The chapter outlines the motivation of the study, which leads to the objectives and aims guiding this study. It further outlines the research process, theoretical boundaries and research expectations.

1.8.2. CHAPTER TWO: LITERATURE REVIEW

Chapter Two discussed the theoretical background in the IS field relating to IS planning in the context of study. The aim is to provide a summary of the theoretical elements from the conceptual framework in the previous chapter. The review provides a comparative study on related EA research bodies from both industrial and educational domains as respected sources of EA research. The chapter build on EA research, to highlight issues arising such as, motivation, tools, and benefits.

1.8.3. CHAPTER THREE: RESEARCH METHODS

This chapter provides a review of philosophies on ontologies, epistemologies and methodologies underpinning IS research. The chapter illuminates further justifications for philosophical interests and similar choices appropriate from the previous chapter. The chapter presents subsequent methodical approach guiding the research data collection.

1.8.4. CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

Chapter Four provides the approach and justifications of the analysis of the research data. The chapter also provides descriptions of the development of the

research thematic networks, how the codes and themes were identified and categoried. The thematic network highlights a comprehensive list of factors addressing the initial research problem, and towards the development of a framework for the adoption of EA in HE institutions.

1.8.5. CHAPTER FIVE: FRAMEWORK AND DISCUSSIONS

This chapter (Chapter Five) provides a description of the methodical approach towards the framework development of a pragmatic framework for EA adoption within HE institutions. The framework highlights factors that affect a successful adoption of EA in the HE sector, and a model highlighting the best practices for adoption.

1.8.6. CHAPTER SIX: CONCLUSIONS, CONTRIBUTION TO KNOWLEDGE, LIMITATIONS AND FUTURE WORK

Chapter Six summarises the results of the discussions, recommendations and implications of the study outcomes. The chapter discusses key contributions of this research to the body of knowledge, the limitations of the entire research process and future work.

CHAPTER TWO: LITERATURE REVIEW

2.0. INTRODUCTION

Chapter Two provides discussions on EA as a discipline. The table below describes some common IS planning practices in HE institutions. The chapter outlines the motivation and justification for EA adoption in the context of this research. The chapter summarises the role of IT in universities and attempts to understand the justification for EA application in transforming the HE sector. Further discussions on the factors that influence this decision to adopt EA will be presented, to provide detailed understanding of institutional efforts. This chapter particularly contributes to fulfilling the research objective of identifying the drivers for EA adoption in HE institutions.

2.1. ADOPTION OF MANAGEMENT TRENDS

Several studies have been conducted that reflect the gaps and failure identified with the use of existing IS planning practices in organisations. Compared to these practices, EA is a more holistic approach because it provides an institution-wide view of processes, systems infrastructure, ongoing and proposed projects, people resources and the organisational structure when making a decision to change or improve key aspects of the institution. IT decisions are made with little information on the impact of such change and the effect on the administrative processes or the key stakeholders of the processes. Such change could include, to expand the capability of the institution to handle an increase in the volume of students enrolment in a new academic year. HE institutions are constantly under pressure to also be more efficient, by adopting cost effective ways to improve IS management. In responding to these pressures, IT managers and senior managers are always seeking new and efficient techniques to address these types of issues. The influx of some of these management practices into HE institutions from the private sector, are considered as management fads (Birnbaum, 2000). One reason why some of these trends have had considerably amount of attention is because they are perceived as a silver bullet, and

HE institutions become wary and reluctant to trial them (Cerych & Sabatier, 1986). Very few HE institutions adopt these practices, and usually championed by key influencers and major stakeholders within the institutions. Some studies show that most older and larger institutions, are seen as bureaucratic and conservative to change, such as, adopting a management trend or industry-driven innovation. Rightfully, these institutions prefer to maintain consistency with tried and tested techniques, to minimise disruption, preserve institutional values, norms and stabilise internal working cultures. Hence, they restrain from trailing behind industry-based fads (Clark, 1983). Table 2.1 identifies some common IS planning methodologies and techniques that have been popularly used in the HE sector (Birnbaum, 2000; Clark, 2008). The table highlights areas of applications and gaps identified in the use of these techniques. Some of the techniques limit the ability for users and adopters to collaborate with change stakeholders because of the heavy-handedness in the approach. Some of these techniques may be reinvention of previous trends based on Birnbaum's life cycle of management fads (Birnbaum, 2000). It is difficult to determine the extent of transformations attributed to these techniques and there is not a comprehensive list available documenting such facts. An innovation or technology alone cannot radically change IS planning dramatically, as much as, institutional change is more complex than mere innovation adoption. Institutions in turn, can learn from these techniques because the innovation provides opportunities to examine internal practices from another perspective (Ewell, 1999). In comparison with these existing techniques, EA attempts to replicate real world scenarios by designing what is identified as the *current state* or *baseline architecture* and the *future state* or *target architecture*. The use of an EA framework helps to capture existing state of the business and the impact of change. The Open Group Architectural Framework (TOGAF) is used to design these instances, identify opportunities and solutions, design migration and implementation plan that manages the transition to the desired state. Also, EA is used to engage various stakeholders in the development and implementation phases, looks at all strata of the organisation and the tools are business-friendly (The Open Group, 2006).

COMMON IS PLANNING APPROACH USED BY UNIVERSITIES	DESCRIPTION	APPLICATION	GAPS IDENTIFIED
Project Management	The planning, organisation, monitoring and control of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria. The project manager is the single point of responsibility for achieving this.	Project implementation approach	The second key limitation of the technique as its difficulty to replicate the real world scenario. The fifth and sixth limitation are failure to predict unforeseen problems, and constrained activities that do not allow a holistic view of the organisation, (White & Fortune, 2002, p. 9; Harpham, 2009, p. 1).
Business Systems Planning	Involves a top-down planning with bottom-up implementation. The business mission, objectives and functions are used to determine the business processes. The processes are analysed based on the data needs (Lederer & Salmela, 1996). Organisations identify a portfolio of IT applications to achieve business objectives (Lederer & Sethi, 1998; Teo & Ang, 1999, 2001; Wexelblat & Srinivasan, 1999).	Data alignment approach.	Adequate documentation but lacks implementation plans (Lederer & Sethi, 1988).
Information Systems Planning	An interdisciplinary field, views the enterprise as a system and applies theories of systems engineering to enterprise problems and issues.	Not found	Not found
Management by Objectives	Requires all managers to set specific objectives to be achieved in the future (Thomson, 1998).	Bottom-up and teamwork approach to management objective setting.	Focusses on efficiency, business process reengineering, increase competitive advantage (Teo & King, 2001).
Information Engineering	A technique for building enterprise, data, and process models to form a comprehensive knowledge base for maintenance of the IS structure (Martin, 1983).	Alignment approach.	Takes a very technical perspective (Lederer & Sethi, 1988).

TABLE 2.1. IS MANAGEMENT PRACTICES COMMON IN HE INSTITUTIONS.

2.3. EA IN IS PLANNING RESEARCH CONTEXT

Adopting Webster & Watson's approach to literature search, several databases were identified (Webster & Warson, 2002). The review consisted of existing literature in EA from university libraries, electronic access to specific peer-reviewed journals such as, Information and Management journals, Management of Information Systems Quarterly, and International Journal of Management Science. These also

included conference papers and other industry publications. The review shows that EA embodies a wider scope of activities within the IS discipline such as, the business of the enterprise (i.e. processes and products representing the business architecture), the technologies (technology and application infrastructure) and the stakeholders or business owners. EA takes an approach into architecting the entire 'enterprise' in the process of planning for change (Spewak, 1992; Schekkerman, 2004; Bernard, 2004 and Doucet et al. 2008). Research identifies three aspects of EA as the business, application, technology and data architectures (Spewak, 1992). On the other hand, EA is defined as a meta-discipline that embraces and supplements extentions into two disciplines namely, the business and systems architectures (Bernard, 2004; Hjort-Madsen, 2009). It addresses areas such as, the application and business architecture (Hammer & Champy, 1993), business process management (Smith & Fingar, 2003), systems planning (Bernard, 2004), and security architecture (The Open Group, 2008). EA planning involves the logical classification of these components making up the enterprise, which other IS planning techniques have adopted as well (Lederer & Samela, 1996; Ward & Peppard, 2002). Hence, it is justifiable to say that if EA addresses issues of business and IT alignment, and change requirements for the organisation to be more efficient in deploying IT solutions, then it should fit within the IS planning context. Recently, in national governments, EA is deployed for transformation programmes to deal with interoperability issues (Hjort-Madsen, 2009). Table 2.1. Highlights some of the existing IS planning techniques familiar in HE institutions. It shows that there has been more technical focus or more IT-driven solutions for the business in previous times. The claim for EA is that IT solutions are more business-driven, with the stakeholders driving the change, to ensure that the resolutions are specific and relevant to the business needs. Table 2.2. Identifies some key studies conducted by mainly EA research groups, who are major proponents of EA. The table shows that there are more qualitative studies than empirical evidence of EA case studies (Boucharas, 2010). Drawing from the report in Table 2.4. Adopting a interpretivistic approach to this research is appropriate, to conduct with motivation to understand an in-depth context of HE institutions as early adopters of EA. The proposed approach will include in-depth interviews with relevant institutions, review of published documents, and participation with focus groups consisting of members of the institutions as practitioners of EA. Below are other publications and research approaches adopted. Both tables show that there is little or no research that has

identified the practice of EA in an educational sector, hence proving that this research is relevant to the EA community and HE sector.

Research Groups & Institutes	Research Project	Research Approach	Authors
École Polytechnique Fédérale de Lausanne(EPFL), Switzerland	Systemic EA Methodology (SEAM)	Epistemological foundation - constructivistic; Ontology - reuse of previous standards, p.4, systems theory.	(Wegmann, et al. 2007) Business and IT Alignment with SEAM
Telematica Institute, The Netherlands	ArchiMate modelling language	Not explicit - conceptual models applied across several case studies	(Lankhorst et al. 2005) Enterprise Architecture at Work
University of St. Gallen, Switzerland	Business Engineering Framework	Conceptual, case study and empirical foundations, research design cycle, p. 4.	(Kurpjuweit & Winter, 2007).
Technical University of Berlin, Germany	Development of an Enterprise Application Integration model	Exploratory study, survey, empirical data, p. 2.	(Aier & Schoenherr, 2005).
Technical University of Munich	Ongoing development of a technical EA meta-model	Use of case studies and surveys, p. 4.	Technical report
Royal Institute of Technology (KTH), Stockholm	Development of an EA framework based on views and viewpoints, analysis of architectural models of IS in the utility sector	Conceptual, based on extensive literature analysis, case study approach, p. 4.	(Ekstedt, 2004; Plazaola, 2009).
Journal of Enterprise Architecture (JEA) School of information Studies, Syracuse University, USA; Copenhagen Business School, Denmark; IT University of Copenhagen, Denmark; IT Research Institute (ITRI), University of Jyväskyla, Finland	Journal publication	Case study	(Hirvonen, 2005; Pulkkinen, 2008; Hjort-Madsen, 2009) (Bernard, 2004; Doucet et al. 2008) (Turner et al. 2009 McDonald, 2005; Ross, 2003; Ross et al. 2006)
Technical University of Lisbon, Portugal	Information Systems Architecture meta-model	Conceptual, case study approach, p. 4.	Technical report
Trends in Enterprise Architecture Research (TEAR)	Conference Proceedings	Method Engineering, Architectural Analysis, Enterprise Engineering, Enterprise Ontology	(Johnson & Ekstedt, 2007; Schelp & Winter, 2009)
MIT Sloan School of Management - Center for Information Systems Research, USA (MIT-CISR) IMD Business School, Switzerland	Issues of management and use if IT in complex organisations. To develop business frameworks that address IT-related challenges.	Case study research, +400 companies mostly in the private sector.	(McDonald, 2005; Ross, 2003; Ross et al. 2006)

Research Groups & Institutes	Research Project	Research Approach	Authors
School of Computing and IT, Griffith University, Australia; IMS-LAPS (Manufacturing Automation), University Bordeaux, France; AGIP (Automation and Industrial Engineering), University Metz, France.	IFIP-IFAC Task Force on Architectures for Enterprise Integration Generalised Enterprise Reference Architecture and Methodology (GERAM)	Enterprise Engineering	(Bernus & Schmidt, 1998; Bernus et al. 2003; Chen et al. 2008)

TABLE 2.2. EA RESEARCH BY RESEARCH GROUPS AND INSTITUTES.

Table 2.3. Highlights some of the key research publications identified during the initial literature review. These studies are largely conducted in organisations with specific requirements for change in areas involving issues of integration, performance and efficiency levels, addressing complexities and improving overall service to consumers. Hence, research data and findings are qualitative.

Publication & Author	Key research question & focus	Chosen research method	Data gathered	Conclusions drawn
Towards an Enterprise Architecture for Public Administration using a top-down Approach (Peristeras & Tarabanis, 2000).	Solely automating existing business processes, without changes to the organisational structures and roles has proven to be unsuccessful, p. 1. Study looks at a systems integration of a Reference Architecture for public administration.	Framework development based on existing Enterprise Architecture Frameworks; the Zachman Framework and Spewak's EA planning, p. 3.	Not known	Proposed a model for building an Information Architecture for Public Administration (PA) based on PA theory and Information Systems literature, p. 6.
Enterprise Information Architecture (EIA): Assessment of Current Practices in Malaysian Organisations (Razak, et al. 2007).	To assess the current practice of EIA in Malaysia public and private sector organisations	10 case studies (public and private sector). Unit of analysis: IS planning department, interviews, documentation & questionnaires	Qualitative & Quantitative	Majority of the organisations practice some kind of enterprise information architecture either in-house or outsource to third parties. It gives a general outlook of EIA implementation in the selected organizations, which could be incomplete or not adequately addressed. The study revealed a poor knowledge and understanding of EA, p. 1.

Publication & Author	Key research question & focus	Chosen research method	Data gathered	Conclusions drawn
Enterprise Architecture Integration (EAI) in E-government (Janssen & Creswell, 2005).	To investigate the impacts of Enterprise Application Integration on the performance of business processes, p.1. To describe an activity-based approach to how a business case for EAI in a municipal e-government setting can be made, p. 2.	Literature survey leading to the development of a systematic model. 1case study, observations.	Qualitative	The research results provide insight into the implications of EAI, used to support information sharing and integration of service processes, so the benefits and implications can be assessed, p. 1. The introduction of EAI requires a change of business processes and procedures to accommodate additional cost, commitment of the actors, and related benefits. Simulation and animation helped to identify innovative solutions and to demonstrate the benefits, p. 9.
Enterprise Architecture Implementation and Management: A Case Study on Interoperability (Hjort-Madsen, 2006).	To study why public agencies implement EA programs and the interoperability challenges they are faced with when governing these programs at different levels and different functions of government, p. 2	Copenhagen University Hospital, Denmark case study, Danish government health sector, interviews with the chief architect from the Copenhagen Hospital Cooperation, p. 2. 11 semi-structured interviews, official documents.	Qualitative, data, Interpretive, analysis conducted through the lens of institutional theory and political science discipline, p. 2.	Interoperability is not just a technical issue. Economic and political factors are as important when implementing EA programs in government, p.1. EA programs must encompass public sector dynamics (and limitations) as well as being agile in the application of interoperable e-government services, p. 8.
A Complex Adaptive System Perspective of Enterprise Architecture in Electronic Government (Janssen & Kuk, 2006).	To understand the complexity of the interactions between the central and the local governments, p.2; to understand the use of EA in the Dutch (Netherlands) public administration, p.9.	11 e-government projects developing an EA, comparative case studies, semi-structured interviews, theoretical sampling applied to case selection, internal memos, website research, consultancy reports, p. 3.	Qualitative	Solely breeding of diversity is not sufficient, there is need to have a focal point to concentrate activities and efforts. An increase in the number of interactions result in new and better initiatives, p. 9.

Publication & Author	Key research question & focus	Chosen research method	Data gathered	Conclusions drawn
The Integrated Enterprise: Enterprise Architecture, Investment Process and System Development (Emery et al. 2007).	Organisations have difficulties aligning IT initiatives to strategic business goals. IT initiatives are developed in silos, and there is lack of an overall approach.	A system case study	Design	There is the need to ensure a good project management and implementation of an Integrated Enterprise Life Cycle (ITEC) to create a comprehensive IT governance and business/IT alignment. An organisational structure for managing and executing the ITEC.
Analyzing Enterprise Architecture in National Governments: The cases of Denmark and the Netherlands (Janssen & Hjort-Madsen, 2007).	To critically understand the development of National Enterprise Architecture (NEA)	2 case studies in Denmark and the Netherlands,	Qualitative	There is a need for broader perspective on NEA, how it is used and governed over time given the institutional setting. Analysing NEAs should include the institutional environment, governance and the take up of the NEA by studying implementations, p. 10.
Analyzing Enterprise Architecture Integration at the DHS Using the Zachman Framework (Susarapu & Baker, 2007).	To show that by developing an integrated EA based on a standard framework, as opposed to developing a patchwork integration plan for all existing enterprise systems, can implement a well-defined, robust EA that will optimise its future strategic and operational outcomes, p. 172.	22 Federal agencies case studies, p. 172.	Qualitative	Developing an enterprise-wide IT architecture is time-consuming and demands much commitment from every stakeholders. The DHS should continue to build its EA based on the ZF by solidifying the defined scope of EA integration. Also to continue to develop its architecture by specifying a detailed logical and physical model, that will bring the planned architecture into production. Caution should be taken to ensure each architecture fits with the overall strategy, p. 176.
Enterprise Architecture in Government: Fad or Future? (Hjort-Madsen & Pries-Heje, 2009).	To understand the purpose of EA and what has driven the use and adoption of the EA concept in Danish central government - looking at public sector agencies and their IS planning approaches, p. 2.	4 government agencies, 2 focus groups, 2 interviews, official documents, p. 3.	Qualitative	The formation and adoption of EA in government is driven by compliance with central guidelines and imitation of 'best practice' that is characterised by management 'fashions.' EA in government must provide a comprehensive and coherent view across business, information, and technology; not just to guide the design of IT systems - but to deliver business change supported and enabled by IT, p. 9.

TABLE 2.3. EA RESEARCH FOCUS AND PUBLICATIONS.

2.4. PLANNING FOR ADMINISTRATIVE REFORMS

Institutions operate more as cottage industries rather than as enterprises, especially in application design and developments (Middlehurst, 2004). Technologies are custom-made to meet specific to business needs and are not mass-produced for a wider consumer group. Institutions that focus on such homegrown applications tend to have more silos and legacy systems and lack the ability to integrate with other technologies. The issues with interoperability and alignment persist in existing technology infrastructure. The changing patterns emerging in the sector suggest that institutions would need to address these issues more rapidly, to maintain market relevance. This would not deter the vision of the education sector in the creation, preservation, transmission, and application of knowledge portrayed in any university's mission statement (Duderstadt, 2000). Dolence and Norris stated that institutions would need to try different approaches to survive the transition to the Information Age (Dolence & Norris, 1995) and institutions that remain open to innovation are more likely to remain competitive and successful (Middlehurst, 2004). Such changes remain difficult for some universities lacking the sophistication offered by maximising institutional resources and developing enhanced business capabilities.

IT plays a vital role in higher institutions, as a nexus between administrative operations and communication between business owners. IT also supports administrative services, international research, self-service facilities for students and management functions. The ability to respond to business demands is based on the level of flexibility the organisation possesses, and the ability to adapt its operating model to suit these demands. Some of the issues the JISC identified during its preliminary study into the IT landscape in HE institutions can be summarised into five categories: *(i) Lack of coherent information and common understanding of business products and services, (ii) The need for proper governance of key data resources and institutional structures, (iii) Large legacy and application landscape, which results in many complexities and inefficiencies, (iv) Many duplicated and isolated functionalities resulting in low levels of reuse, and (v) Lack of interoperability between systems in isolated units* (JISC Techwatch Report, 2008). The result of such fragmentations is also identified as '*islands of automation,*' lone processes and a high level of complexity creating bottlenecks for the organisation (Hjort-Madsen, 2009). Ad hoc and point system solutions are usually adopted for immediate resolutions, but inadvertently; make it difficult to apply the business to change and opportunities. JISC plays a crucial role as, the driving force for innovation

in the UK education system. JISC offers support to HE and FE institutions by translating research findings into actionable steps, availing financial resources and expertise to undertake new market trends suitable to institutions. JISC's goal includes helping institutions resolve these issues earlier stated, hence, the driving force of EA adoption in the UK HE sector. The adoption EA concepts and principles, is proposed to help institutions manage changes effectively (Goethals et al. 2006). These areas of EA application show that EA may be of value to the HE sector. Three aspects of change that institutions need to be aware of are: *(i) Change in the institution should be managed and coordinated in a formal way, (ii) Change should should be implemented taking into consideration, strategic goals even while fulfilling pressing tactical goals, (iii) Change is more effective with a broader knowledge of the business assets, which include, structures, culture, infrastructure and people.* (Lawrence & Lorsch, 1986; Broadbent & Weill, 1997; Lipschutz, 2004; Goethals et al. 2006). Researchers agree that the HE sector is currently in a transformational phase (Duderstadt, 2000).

2.5. RELATIVE VALUE OF EA TO UNIVERSITIES

This section highlights three key benefits of EA suggestively relevant to HE institutions. This summary is based on initial findings from the JISC report, which highlight issues institutions face that include: *duplicated systems functionalities, poor governance and reuse of IT resources, issues in interoperability between departments and business units within the institution, lack of coherence in understanding products and service offerings, and large collection of disparate systems and business applications.* Arguably, the application of EA should address some of these issues based on existing body of knowledge in EA application across public government organisations and other private sector organisations. The following three areas of application and potential benefits of EA are addressed. They are: *(i) IT and Business Alignment, (ii) IT Governance, and (iii) Institutional agility*. These areas will be benchmarked against the research findings and analysis in further chapters.

2.5.1. IT AND BUSINESS ALIGNMENT

EA is an enabler for alignment between IT and business goals (Ross, 2003; Sauer & Willocks, 2004; Van der Raadt et al. 2005; Gregor et al. 2007). The lack of such alignment limits the opportunities for the organisation to adapt to change in

implementing its business strategy (Iivari et al. 1998; Luftman, 1998). When institutional resources are better coordinated, EA is said to ensure that IT brings value to the institution. Business integration with IT ensures that business units within an organisation share and understand each other's data (Lawrence & Lorsch, 1986; Ross et al. 2006). On the other hand, IT systems are expected to be efficient in supporting these business events. The EA tool helps to decipher the application landscape, by identifying the many applications used across various departments and business units. These applications need to be consolidated or streamlined to reduce cost and improve efficiency. As IT functions to support the institution, its goal includes understanding these business decisions, to better serve, and ensure that IT resources are channeled appropriately and effectively (Katz, 2003; Albrecht et al. 2004).

2.5.2. IT GOVERNANCE

As an organisation's corporate performance increases, the IT capabilities need to be managed and governed effectively (Hughes, 1998; Iansiti & Favaloro, 2006). IT governance specifies the decision rights and accountabilities within the organisational structure, to encourage desirable behaviour in the use of IT resources (Weill & Ross, 2004; *adapted by* Hjort-Madsen & Janssen, 2007). Reuse of IT resources is only possible with adequate governance measures. This does not necessarily stifle resources and restricts access, but ensures business managers can make sense of business resources and capabilities (Spewak, 1992). Effective communication between the business of the institution and supporting IT resources would improve understanding and appreciation of potential business solutions (Goethals et al. 2006).

2.5.3. INSTITUTIONAL AGILITY

Traditional organisations in the wake of current economic restructuring the need to reinvent existing business models to maximise new market opportunities. The Infosys EA Survey reported an increase in the number of companies seeking process flexibility and simplicity in their IT architecture (Aziz et al. 2005). Every organisation need to be able to adapt current IT resources to meet new business requirements and without declining performance (Voloudakis, 2005). Institutions also need to build adaptive systems and structures, to be responsive in the sector's dynamic environment. The application of EA techniques to the institution business and

administrative environment, should improve the ability of the institution adapt to changes.

2.6. PRE-ADOPTION REQUIREMENTS IN UK UNIVERSITIES

An innovation is targeted to effect change either in the social or economic status in a community, while innovation is recognised as a significant component for change in any modern economy and seen as a tool for transformation (Drucker, 1985). It is a recognised need for a role change in the use of technology; from operational enablers to more strategic and transformational roles (Dearing Report, 1997; Lambert, 2003; Duke et al. 2008; JISC TechWatch Report, 2009). This need is stifled by the fact that public sector institutions advance at a slower rate in adopting new IT strategies than their counterparts in other private sector organisations (Schoeniger, 2000; Birnbaum, 2000; Scholl, 2005). One challenge universities face is the availability of skill sets and appropriate knowledge in the adoption. One of the research objectives of this research is to understand the rationale towards the innovation-adoption decision taken by these universities to adopt EA. There are several characteristics that determine this innovation-adoption decision. Innovations are more likely to be rapidly adopted if perceived with higher relative advantage, compatibility, trialability, observability, and less complexity (Tornatzky & Klein, 1982 & Rogers, 1995). These factors influencing the decision are: *(i) Relative Advantage or relevant benefit of EA to the institution, (ii) Compatibility with values and existing norms of the institution, (iii) the Cost of financing the adoption, cost of purchasing new systems (perceived as* either affordable or exorbitant*) and training required for upscaling of personnel, (iv) Complexity of EA concepts and techniques, (v) Trialability in the use and initial adoption of EA - is an EA framework too large to cover small institutional projects, (vi) Observability in achievable and immediate benefits to the institution.* Additional qualifying criteria set by the committee include *institutional readiness* and supporting *senior management decision*. These factors are discussed in the following section.

2.6.1. INSTITUTIONAL READINESS

At the initiation of the EA pilot programme, institutions needed to show evidence of readiness to do EA; as an established portfolio for IT planning and institutional change. Support for the requirement of an integrated IT platform and an understanding of the need to consolidate disparate IT capabilities and resources would also prove the institution's readiness to apply the architectural concepts. An

effective governance structure that would monitor the implementation needed to be in place, with the use service-oriented approaches was also solicited, to promote adaptive architectures and connectivity. The successful institutions were driven to implementing rapid changes and were considered as potential candidates (JISC Circular, 2007).

2.6.2. SENIOR MANAGEMENT DECISION

The management decision to adopt can be influenced by the lack of understanding of EA and other misconceptions as an industry-based practice, unsuitable for HE institutions. Some stakeholders express concern over adopting EA as a management *hype* and soon-to-fad. Participating institutions needed to secure either a *top down* management commitment that ensures acceptance of EA across the institution, or a *bottom up* approach using a systems-to-service approach that would convince key stakeholders of the viability of EA adoption. The latter results in a delay to the decision to adopt until EA benefits can be substantial.

2.7. USE OF AN EXISTING THEORETICAL FRAMEWORK

In understanding the adoption in a public sector context, a similar study will be adopted to benchmark findings from this research. A theoretical framework reviews and compares the application of EA across national government agencies (Janssen & Madsen, 2007). The framework was designed to compare the National EA (NEA) work in the Netherlands and Denmark public sector. Conclusions drawn from the study indicates that the NEA initiatives are instruments to drive the public-sector organisation towards an integrated strategy from both the business and technology perspectives. Key government actors, management structures and political vision have significantly influenced the NEA programs. In summary, EA work needs to be conducted on a broader perspective or at a national level because there has been no mandatory legislation backing the adoption. Hence, the NEA suffered prioritisation and potential for widespread adoption. Table 2.1. Shows the framework consisting of five elements and their descriptions used to evaluate the NEA programs.

Elements	Description

Elements	Description
1. Policies, actors and structures	Encompasses the environmental and political drivers for EA. The strategic objectives for architecture are provided by political actors and constrained by democratic structures.
2. Governance	Architectures evolve over time and consequently governance structures and mechanisms are important to guide and encourage desired behaviour.
3. Architecture frameworks and methodologies	Architecting takes a resource-based view on public administration and use frameworks and planning process methodologies.
4. Architecture principles and standards	Architects use standards, principles and guidelines for guiding implementation.
5. Implementations	The scope operate across multiple implementations among many agencies and disciplines.

TABLE 2.4. FRAMEWORK FOR ANALYSING NATIONAL EA PROGRAMS (JANSSEN & HJORT-MADSEN, 2007).

Further modification to the evaluation framework is made by a study comparing NEA programs in 15 different countries conducted in collaboration with the Finnish national government (Liimatainen et al. 2007). The framework is extended by two additional elements: *(i) Benefits of the NEA work, and (ii) Evaluation of the NEA work.*

Elements	Description
1. Policies, actors and structures	Identifies political and environmental drivers for NEA work. The strategic objectives for architecture are provided by political actors and constrained by democratic structures.
2. Governance	Specifies NEA's governance model and practices that are needed for keeping the architecture current.
3. Architecture frameworks and methodologies	Definition of the NEA, framework used and the architecture process.
4. Architecture principles and standards	Standards, principles and guidelines used for implementation, and the change management. Specifies adoption of international interoperability models.
5. Implementations	NEA implementations and cross-public sector projects.

Elements	Description
6. Benefits	Benefits of the NEA work and their measurement, experiences from NEA work and its usefulness.
7. Evaluation	Special characteristics, advantages and disadvantages of the NEA work.

TABLE 2.5. FRAMEWORK FOR ANALYSING NATIONAL EA PROGRAMS (MODIFIED BY LIIMATAINEN, HOFFMANN & HEIKKILA, 2007).

The research findings will be interpreted using the latter version of the framework and modified where necessary, to compare the JISC EA pilot programme.

2.8. SUMMARY

This chapter has reviewed existing literature in IS planning field and the application of EA in varied context of study. Some of the issues institutions face in planning and managing directional steps towards transformation were discussed. There is clearly a trend in using EA in national transformation programmes across the world. EA is not exclusive to the debate of its appropriateness and suitability in these contexts, nevertheless, HE institutions. The motivation for EA adoption in these institutions has been addressed in this chapter, which clearly answers one of the objectives of this research. Current research shows that EA is adopted in diverse types of organisations using qualitative techniques to understanding the purpose and experiences in these organisations. This chapter clearly shows that there is little research conducted on EA adoption in HE institutions. So far in this study, EA is seen as a legitimate innovation for adoption in context, and it plays a significant role in the transformation of IS planning the HE sector. The next chapter elaborates on the research approach and methodologies adopted to conduct this research study.

CHAPTER THREE: RESEARCH STRATEGY

3.0. INTRODUCTION

This chapter provides a review of the research philosophies, paradigms, approaches and methods chosen for this research design. The researcher presents justifications of the research approaches considered, rejected and adopted. An in-depth description of the research strategy outlines the study progression in achieving the defined aims and objectives set out in chapter one. The aim of this chapter is

designed to address the philosophical stance adopted by the researcher, as suitable approach to answer the research question. However, this research will highlight other contrasting paradigms that may influence the outcomes of this research study.

3.1. RESEARCH PARADIGMS

A research paradigm is defined as the '*worldview*' of the researcher or a way of examining social phenomena from which particular understandings can be gained and explanations exempted (Saunders et al. 2007). Research paradigms are also described as the *'basic set of beliefs'* or assumptions that guide human action (Guba & Lincoln, 1994; Creswell, 1994). It is broadly agreed that a research paradigm has significant implications to a research because it represents the way the researcher sees the world, which subsequently influences the process and outcomes of the study presented. It is thus imperative to know what these beliefs or assumptions are that potentially influence this study. Denzin & Lincoln (2005) identifies three constituents of paradigms, which are: ontology, epistemology and methodology, which will be referenced in this study.

3.1.1. ONTOLOGY

This is a branch of metaphysics that deals with the nature of being. In other words, it studies what exists and what is real. Two aspects of ontology are objectivism and subjectivism (Saunders et al. 2007). Objectivism portrays the view that there exist social entities external to social actors concerned with their existence. While subjectivism portrays the view that a social phenomenon is created from the perceptions, and consequent actions of those social actors concerned with their existence. There is a relationship between what exist and the substance of reality.

3.1.2. EPISTEMOLOGY

Epistemology is the investigation of what distinguishes justified belief from opinion or what constitutes acceptable knowledge in a field of study (Saunders et al. 2007). It deals with the theory of knowledge especially about its methods, validity, and scope of the study. Typically, epistemology addresses the following questions: *"What is knowledge? What constitutes acceptable knowledge in a field of study? What is the relationship between the inquirer and the known? How do you interpret*

the world?" Epistemology provides a set of evaluative criteria for knowledge claims and attempts to answer what distinguishes proven knowledge from other knowledge form; hence it deals with the skepticism about different knowledge claims (Heylighen, 1991; Krauss, 2005).

3.1.3. METHODOLOGY

Methodology deals with the process by which knowledge is systematically acquired in a particular research study. Methodologies generate questions to know the ways of finding out knowledge and how to go about finding out this knowledge. It is described as the best means of knowledge acquisition about the world (Denzin & Lincoln, 2005).

3.2. CLASSIFICATION OF RESEARCH PARADIGMS

There are broad classifications of paradigms in research, such as *positivism* and *interpretivism* (Fitzgerald & Howcroft, 1998). This research focuses on four groups of paradigms as *positivism*, *realism*, *pragmatism* and *interpretivism* (Saunders et al. 2007).

3.2.1 POSITIVISM

Positivism holds claim that every rationally justifiable assertion can be scientifically verified or is capable of logical or mathematical proof. Myers (1997) suggests that positivists make assumptions that reality is objective and can be determined discreetly and described by measured properties independent of the observer. This epistemological assertion states that every verifiable research should be conducted in a controlled environment, where the observable social reality is measured using highly structured methodology. In principle, positivistic research converges on the 'true' state of events. Positivism is widely held among natural scientists that attribute the success of current scientific breakthroughs in a modern world searching for answers (Hussey & Hussey, 1997; Capra, 2002). The end-product of a positivistic research includes law-like generalisations or the cause-effect laws that are applied across similar contexts (Lincoln & Guba, 1994; Saunders et al. 2007). Certain assumptions that support the positivistic views include that both the investigator and the object in study are independent entities that should be studied in

without interference, thus causing the research results to be value-free (Lincoln & Guba, 1994, Myers, 1997, Remenyi et al. 1998). Although, positivists argue that there is complete exclusion from the object of study, it is hard to agree that the decision for the choice of study is seemingly independent or free from the inclusion of researcher's value system. Consequentially, the researcher rejects the use of structured experiments and quantitative methodologies in this research context. The aim of this research is to explore the meaning and values attached to EA and the relationships with the HE community.

3.2.2 REALISM

Realism is an epistemological approach that is constrained to scientific enquiry into knowledge (Saunders et al. 2007). Its philosophy is based on the doctrine that universals or abstract concepts have an objective or absolute existence independent of our knowledge of their existence. Two types of realism may be adopted in business and management research, which are, direct and critical realism. In direct realism, what we experience through our five physical senses portrays the true state of our current world, while, critical realists argue otherwise; that what we experience are sensations, images and illusions of the real world. On the other hand, business and management researchers study the world in which the objects of their research live in - their social world in a wider context so that there is a better understanding of the social structures that trigger the phenomenon (Bhasker, 1989).

3.2.3 PRAGMATISM

Pragmatism is used to consider the actions and consequences of man-made situations. A pragmatic research is focussed on the research question as the most important element in determining the appropriate research approach, while others propose that the focus on the research problem should drive the inquiry (Patton, 1990; Cherryholmes, 1992; Tashakkori & Teddlie, 1998; Rorty, 1999). Pragmatism is not committed to any one system of philosophy and reality, as it allows researchers to draw liberally from both qualitative and quantitative methods to address the research question. Individual choices are exerted in the choice of methods, techniques, and procedures that suits the purpose of the research, thus, pragmatism is applied in mixed methods research during data collection and analysis rather than be constrained to one method (qualitative or quantitative), in the search of the *'what and how'* of the phenomenon. Researchers believe in an external world independent of the mind as

well as that lodged in the mind, but also of an extension of the real world and situational laws. This ideology reinforces practical considerations for understanding what is both meaning and truth for business and management researchers (Creswell, 2007).

3.2.4. INTERPRETIVISM

An interpretivistic researcher advocates the need to understand the differences between humans in our roles as social actors (Saunders et al. 2007). The term '*social actors*' addresses the role of people as constructors of the world around them, thus research should be conducted among people rather than on objects and things (positivism). Human activity is a collection of symbols or literary text expressing layers of meaning, which usually requires conventional hermeneutical techniques for interpretation and a dialectical interchange for comparison and contrast (Miles & Huberman, 1994). Hermeneutical and dialectical methodologies are mainly used in qualitative research to explain the stability of behaviour or the natural phenomenon from the individual's viewpoint by adopting an emphatic stance (Boland, 1991). The philosophical nature of interpretivism suggests that individual construction of their world should be elicited and refined through interaction between the investigator and the respondents. Some argue that an interpretivist perspective is appropriate in business and management that deals with human behaviours, which is seen as a complex setup in research. An interpretive study seeks out *'emic meanings'* held by the researcher and actors within the case, although, it is difficult for the researcher to be completely '*detached'* from the object of study (Miles & Huberman, 1994; Denzin & Lincoln, 2005). The researcher was somewhat detached or considered as an outsider from the community at inception of the study, but this was changed when the researcher was offered a role as a support staff to the JISC community. This development does not neutralise objectivity in the research but changes the role to become an 'insider.' This boosts the position of the researcher to understand the world from the viewpoint of the participants. Individuals share their views and experiences in different ways and a qualitative research is enables the researcher the ability to ask broad and open-ended questions to the participants. Participants will be encouraged to share the meanings they attach to EA in their own context.

3.3. RESEARCH APPROACH

There are three types of inquisitive techniques or methodologies identified in research, namely, quantitative, qualitative and mixed methods (Mertens, 2005; Creswell, 2007). Quantitative research is a means of testing objective theories by examining the relationship between variables, to deduce explanations and the ability to generalise and replicate research findings in similar controlled environments. While, qualitative research seeks to explore the meaning 'social actors' ascribe to a phenomenon, understand the complexity of the event and investigate the casual determination of these events (Ragin, 1992; McNabb, 2004). These interpretations constitute different meanings and perceptions of the individuals, who are the interpreters and designers of their immediate world. A mixed method approach combines both qualitative and quantitative approaches to understand these interpretations components. It employs the strengths of both methods in an inquiry (Creswell, 2007). Researchers who feel the bias and limitations of one research strategy of inquiry welcome this ideology. Mixed methods approach seeks to eliminate biases and strengthens arguments with quantitative and qualitative data. The three types of mixed methods are sequential, concurrent and transformative. A sequential approach to mixed methodology is adopted in the initial phase of this study, where the researcher decided to conduct a preliminary survey of UK HE institutions to identify the number of institutions that are involved in adopting EA. This survey was conducted at the early stage of the early stage of this research. The researcher was invited to attend one of the closed-group EA workshops as an observer. Questionnaires were distributed to fifteen institutions that were represented. The survey was also intended to highlight areas that may be of interest to the community as the participants were asked to list out issues about EA in their various institutions. The aim of the survey would also assist the researcher to narrow the scope of the research problem. The outcomes of the survey would be followed by a series of interviews based on issues that were highlighted and other issues identified. Unfortunately, the results of the initial survey were insufficient as there were very few respondents. This disqualified the justification to adopt mixed methodology.

3.4. RESEARCH METHODS

3.4.1. ETHNOGRAPHY

Ethnography involves the study of a particular group in their system or environment over a prolonged time (Wolcott, 1990b). The researcher is involved in collecting primary data, such as, observations and interviews conducted with the members of the system. The research process is flexible and typically evolves in context or response to the realities faced (LeCompte & Schensul, 1999). This research method is not usable in this study because it involves a protracted time of data collection.

3.4.2. GROUNDED THEORY

In grounded theory, the researcher generates an abstract theory of a process, action, or interaction grounded in the views of participants. The data collection is divided into multiple stages that assist in the refinement and categorisation of the data. The process focuses on identifying emerging trends and categorisation to enhance the formulation of a research theory. (Strauss & Corbin, 1990; Charmaz, 2008). This research method has been rejected because the researcher proposes to use prior theoretical constructs from an existing research, which helps to manage time constrains in this research.

3.4.3. SURVEY

This approach provides the researcher with quantity or numeric description of data that may include individual or collective opinions, trends, and demographics of a selected research data set. It often includes cross-sectional and longitudinal studies using questionnaires or a structured interview format. The data is analysed and used to generalise the findings to a wider context (Babbie, 1990). A survey was intended by the researcher to identify the number of institutions that were using EA, maturity and issues surrounding their adoption processes. The survey was conducted during one of the EA Practice Group, which had fifteen institutions in attendance and twenty-nine participants. Twenty-five questionnaires were distributed in total by the researcher and six of the questionnaires were returned with only 50% completion. Those represented at the workshop included Project Managers, Heads of IT, Technical and Information Directors and Business Analysts. The results from the

survey showed that there were not many institutions applying EA, hence, the low completion rate. The survey did not provide sufficient data about these institutions because most of them were simply discussing about EA. This research method would have been beneficial if there were a substantive number of adopters in the community then.

3.4.4. CASE STUDY

Case study research method affords the researcher the ability to conduct an in-depth study of a phenomenon in a real-life context, to investigate questions such as the*'how'* and *'why'* of phenomenon (Morgan, 1997; Leonard-Barton, 1988; Robson, 2002; Yin, 2008). Here, the researcher has little or no control over the turn of events. Data is collected using a variety of data collection methods over a specified period (Yin, 1994; Stake, 1995). A case study can be defined by both qualitative and quantitative data based on the interest of the researcher and the phenomenon studied. A case study is unique, specific and bounded within a system to be validly addressed as a qualitative research, although, it is sometimes difficult to specify the boundaries of the case being studied (Stake, 1995). This research proposes to investigate how institutions have adopted EA, their motivation, process of adoption and issues encountered. This method will be adopted for this research because it the cause and effect relationship between EA and IT planning for institutional transformation can be examined within the boundaries of the case studies. There are three types of case study that are identified in research, namely, intrinsic, instrumental and collective case studies (Stake, 1995; *See Table 3*.1). For this research, four case studies were identified as *'early adopters,'* because they are the four institutions participating in the JISC pilots for the EA programme. These cases will be studied to expose and highlight any commonalities or issues of interest. The evidence from multiple cases is often considered more compelling and robust, although, using the concept of replication logic, it helps to deal with contradictory findings and formulate a rich theoretical framework for the adoption of EA in other higher institutions. If all cases suggest similar theories, then the research is able to conclude on its propositions (Herriott & Firestone, 1983; Miles & Huberman, 1994; Yin, 1994). A case study method affords the researcher direct access to individuals involved in the projects as well as official documents, observations of individuals and institutions, and interview transcripts. The misconceptions about using case studies in research, such as, that

they can only be used in preliminary investigations because a case study cannot provide the researcher information about a case that can be used for further propositions (Shavelson & Townes, 2002). In contrast, some of the best researches have used case studies to describe the cause of an action and the effect to the environment (Yin, 2008). The researcher understands that the findings of a case study research may not usually lead to generalisation, especially within a small proportion compared to the whole. The findings may be generalisable to theoretical propositions and not to populations or statistics (Feagin, et al. 1991; Yin, 1994).

Type of Case	Description
Intrinsic	The researcher desires a better understanding of a particular case. The single case is of intrinsic interest to the researcher.
Instrumental	The researcher studies the case as a secondary interest to facilitate the understanding of an external issue, phenomenon, or to redraw previous generalised conclusions.
Collective	The researcher studies a collection of cases that are chosen because the researcher believes an understanding of them may provide better interpretation of the phenomenon.

TABLE 3.1. TYPES OF CASE STUDY RESEARCH.

3.5. THE RESEARCH DESIGN

The perspectives and experiences of the researcher influence a research design. These views and experiences are used to guide how and for whom the research problem is being investigated, what research approach and methods of gathering suitable research data will be used (Creswell, 2007). This is suitable when little research has been conducted on it, or an in-depth investigation is required, or the researcher has limited knowledge on what key variables to examine (Morse, 1994). The structure of a research design is based on four types of research question to be investigated, which are: *what question to ask*, *what data are relevant*, *what data to collect*, and *how to analyse the data*. Table 3.2. Represents the protocol adapted for this research design.

Objective of the study	Data required	Research method	Sample case study questions
Review of the JISC EA pilot programme	Preliminary data	Pilot study	Why are HE institutions adopting EA?

Objective of the study	Data required	Research method	Sample case study questions
The practice in question (hypothesis and propositions)	Qualitative data	Focus group	How do you define EA?
To review of existing EA research	Empirical and qualitative data	Literature review	Using keywords to query academic databases - 'Enterprise Architecture AND Education Sector AND HE institutions.
Motivation, drivers and interests in EA adoption	Qualitative data	Interviews	What motivates your institution to adopt EA?
Innovativeness of the practice	Qualitative data	Focus group	What were your expectations of it? In what way was the practice innovative, compared to other practices?
Outcomes from the practice, to date	Qualitative data	Interviews	What is the impact of EA to your institution?
Benefits and impacts	Qualitative data	Interviews	What use do you think it is going to be to your institution? What difficulties has it presented so far?
Sustainability	Development of a framework	Not applicable	How would sustain EA after the initial JISC funding period?

TABLE 3.2. RESEARCH DESIGN AND PROTOCOL.

3.6. DATA COLLECTION PROCESS

Each participant was sent an initial an email 'Request to Interview' letter and a follow-up phone call. The interviews were conducted face-to-face, while some were conducted through phone calls and skype (internet-enabled) calls. The interviews lasted for an average of ninety minutes; they were recorded with participants' consent and transcribed verbatim. The skill of engaging participants in discussions is a *'favoured digging tool'* in research as the participants are given an audience to express thoughts, and replay their experiences in their own words and expressions (Kvale, 1996; Taylor & Bogdan, 1998; Marshall & Rossman, 2006). In interviewing, the researcher develops a relationship with the interviewee as a way to engage in the participant's social context. This relationship helps build trust, confidence and gives voice to the participant. It is also essential for the researcher to understand the context

in which the participants expresses their views, as well as observe any differences during the workshops (Briggs, 1986; Mishler, 1986). A semi-structured approach was used in interviewing was also adopted by the researcher to allow some level of control over the process, while encouraging the participants some flexibility to their story telling. These conversations are embodied with revelations and streaks of concealed thoughts and intentions of the participants.

3.7. CASE STUDY DESCRIPTIONS

The four institutions selected represent a small percentage of the number of HE institutions in the UK. In this study, the institutions are grouped into pre-92 and post-92 institutions for this research purpose. The pre-92 institutions are known to be traditional and large institutions constituting of different colleges. The post-92 institutions were formerly polytechnic and colleges that gained university status after 1992. The post-92 institutions are described as modern and with less bureaucratic management structures. The structure of the institution, key actors and support from senior management are factors that influence the adoption of innovation in organisations. The descriptions presented include the size of the institution, the EA vision and type of projects.

3.7.1. KEAP, INSTITUTION A

This is a Russell group institution that was founded in 1829. The institution has 19,000 students and 5,000 staff in this research-based institution. It is the third oldest institution based in the UK, with nine schools of study. The institution is known to be multi-faculty led with extensive research conducted in dentistry, psychiatry, biomedical and health sciences, law, medical research, natural and mathematical sciences, nursing and midwifery, arts and humanities. As a Russell group university, the university is known to produce world-class teaching and research. The strategic plan of the institution suggests a willingness to exploit innovative use of IT. Innovative approaches will be used to provide a high standard of communications infrastructure to support staff and students' activities. The KEAP project was funded by the JISC in 2008, to evaluate the utility of EA and The Open Group Architectural Framework (TOGAF). The Virtual Research Environment (VRE) infrastructure project is designed for the research domain. The VRE project is part of the wider Connected Campus, which is an institutional programme for an e-environment with over 25

projects focussing around five areas; an end-to-end connectivity, a connected research environment, technology enabled teaching, e-community, and enabled customer services.

3.7.2. LEAP, INSTITUTION B

This institution is a pre-92 university; which implies its university status was gained in 1992. In 2006, the total number of students was given as 24,442 enrolled and based on campus, and 2,590 employees headcount. The university is one of the largest UK-based institutions. The university is regarded as a contemporary university because of its disposition to innovation and modern techniques in the effective use of technology. The university is one of the first universities to adopt the European Foundation for Quality and Management (EFQM) Excellence Model and Balanced Scorecard approach to strategic planning, management of quality and continuous improvement of IS and its dependent processes. The university has a goal to ensure its Information Systems strategy is aligned with the business growth and opportunities. The senior management of the institution recognise the effect of understanding the business from a high-level view, and a way to keep its focus on the wider goal. The LEAP project was one of the JISC EA pilots in 2008. The project undertaken focused around areas business process improvement, IT governance and service-based approaches to technology resolutions. The student recruitment processes was one of the pilot project.

3.7.3. LEANEA, INSTITUTION C

The institution is a Russell group university founded in 1883. The university currently has a student number of 30,930, and 5,230 staff members. The university is regarded as one of the largest research-based institutions in the UK. The institution is an amalgamation of three university colleges in 1999 and 2004. With about 33 IT and library distributed locations, the management of the IT and the institution, recognised the need to have a more integrated IT infrastructure that would meet the need of an increasing IT service demand. The management was aware of the current challenge and potential issues that arise from mergers. One of the objectives for IT is to facilitate continuous business processes to increase the levels of efficiencies, improve IT infrastructure and to have quality systems. In 2008, the university rolled out the Modern IT Working Environment (MWE), as a strategic programme providing an

integrated platform for students and staff activities. The MWE is a part of a wider programme, *'Creating New Futures'* that supports the institution's transformational initiative. The goals of the programme include the need to reduce data silos, and integrate legacy systems into the new automated functions of the system. The university is regarded as a leader in championing single login to the institutional systems and other portals, such as, the library systems from any location. This functionality was created from the Identity Management project in collaboration with some other institutions, and funded by the JISC. LeanEA became of interest to the IT management group and university senior management group. The project would form part of the wider MWE programme, applying EA concepts to LEAN principles and process improvement to administrative processes and Information Services within the institution.

3.7.4. CAIRO, INSTITUTION D

Founded in 1975, this previous Institute of Higher Education is now a post-92 university status gained in 2004. The institution has four colleges and four schools, which promote interdisciplinary work. The university has a population of 8,500 students. The institution operates with a foundation for executing EA with basis on the principles of Service Oriented Approach (SOA). The approach builds on the work of the Shared Services Agenda of JISC e-Framework initiative for HE institutions. It reflects the university's local agenda to manage an integrated application portfolio ensuring that its relationships with technology vendors are effective and beneficial. There are two institutional projects that sit under the JISC e-Framework agenda, namely, the High Level Domain Architecture (HILDA), and Measuring and Understanding the Systems Integration Challenge (MUSIC) projects. The university has a strong IT management structure that sits within a central decision making body. The executive management teams closely supports the institutional overall objectives to review its information systems architecture and business architecture, with a focus at processes integration across various schools. These areas would form building blocks for the SOA work.

CASE STUDY INTERVIEWEES – GROUP I

Case Study	Role of Interviewee
Pilot Study	Head of Strategy and Policy

Pilot Study	Head of IS&T
Pilot Study	Former Director of Technology Research Group
Pilot Study	Assistant Director of Technology Research Group
Pilot Study	Research Personnel
KEAP, Institution A	Assistant Director
Leap, Institution B	Deputy Director of IS&T
Leap, Institution B	Business Analyst
LeanEA, Institution C	No interviews held but represented at Focus Group
CAIRO, Institution D	Assistant Director
CAIRO, Institution D	Systems Analyst

TABLE 3.3. CASE STUDY INTERVIEWEES.

This category of interviewees represented two groups. First four interviewees represented institutions that were exploring using EA approach within institutional programmes. The next three interviewees represented independent EA practitioners who were knowledgeable about EA in the HE sector. The interviewees were liaising with institutions in building their initial architectures by offering consulting and modelling services. A semi-structured interview was conducted in the same year as above various institutions including the researcher's university. The interviews were recorded and fully transcribed for further analyses.

CASE STUDY INTERVIEWEES – GROUP II

Case Study	**Role of Interviewee**
Institution E	Assistant Director of IS&T
Institution D	Systems Analyst
Institution F	Head of Academic Department
Institution G	Former Lecturer & EA Consultant
Independent	IT Consultant
Independent	EA Consultant for HE institutions
Independent	EA Practitioner in HE institution
Independent	EA Consultant in independent research group

TABLE 3.4. ADDITIONAL CASE STUDY INTERVIEWEES.

There was an opportunity afforded the researcher to work with the core group of EA practitioners in the HE sector. The Enterprise Architecture Practice Group (EAPG) is a forum for institutions with projects using the EA approach. These practitioners have between two to three workshop sessions each year split over two days. The session's focus was on institutions sharing their challenges and experiences

learned while adopting EA. These opportunities provide an aperture for the researcher to listen, ask questions, record discussions, to understand the intricacies of the whole adoption process. The data collected is valuable and adds to the wealth of knowledge understanding EA in the sector. The researcher is able to have brief conversations with potential EA interviewees.

ATTENDANCE OF WORKSHOPS

Workshop	Average attendance over 2 days
Workshop I held at Birmingham in June 2009	36
Workshop II held at Liverpool in December 2010	40
Workshop III held at Aston in July 2011	44

TABLE 3.5. WORKSHOPS AND NUMBER OF ATTENDANCES.

Case Study Description	Interviewees	Type of Research Question	Semi-structured Interviews	Location & Mode of Interview	Total Interview Duration	Focus Group Participation	Document
Pilot Study Institute of Educational Cybernetics	Interviewee 1, Professor, IEC & Lead Champion for JISC EA Interviewee 2, Deputy Director, JISC CETIS & Lead JISC Interviewee 3, Reader in e-Learning & Project Manager Co-educate	Why and How EA? Impact of EA 6 Research Questions	3	University of Bolton/ Face-to-Face	4 Hours	No	0
Post-92 Institution Roehampton University	Interviewee 4, Project Manager, ITMS Department	Why and How EA? Impact of EA 6 Research Questions	1	Roehampton University/ Face-to-Face	2 Hours	Yes	Executive Report JISC Website Institutional Website
Post-92 Institution Liverpool John Moores University	Interviewee 5, Deputy Director, Corporate Information Systems; Interviewee 6, Business Analyst	Why and How EA? Impact of EA 6 Research Questions	2	LJMU Interview & Workshop/Face-to-Face	1.5 Hours	Yes	Executive Report JISC Website Institutional Website
Pre-92 Institution Cardiff University	Interviewee 7, Associate Director & Deputy Chief Technology Officer	Why and How EA? Impact of EA 6 Research Questions	0	LJMU Workshop/ Face-to-Face	2 Days	Yes	Executive Report JISC Website Institutional Website
Pre-92 Institution Kings College London	Interviewee 8, Project Leader, Deputy Director of CeRch Interviewee 9, Software Development Manager	Why and How EA? Impact of EA 6 Research Questions	2	Skype interview/ Birmingham Workshop	1.2 Hours	Yes	Executive Report JISC Website Institutional Website
Post-92 Institution Staffordshire University	Interviewee 10, Learning Development Manager & EA Project member	Why and How EA? Impact of EA 3 Research Questions	1	Staffordshire University/Face-to-Face	2 Hours	Yes	JISC Website Institutional Website
Pre-92 Institution Bristol University	Interviewee 11, Assistant Director of IT	Why and How EA? Impact of EA 3 Research Questions	1	Skype interview	1 Hour	Yes	0
Post-92 Institution University of Bolton	Interviewee 12, Head of IS&T; Interviewee 13, Head of Business Strategy and Planning	Why and How EA? Impact of EA 3 Research Questions	2	University of Bolton/ Face-to-Face	3 Hours	Yes	0
Pre-92 Institution University of West England	Interviewee 14, Senior Lecturer, University of West England, Bristol Business School	Why EA?	1	Skype interview	1 Hour	No	0
Independent EA Consultancy to HE Institutions	Interviewee 15, External Consultant, JISC Interviewee 16, Staff, Manchester University Interviewee 17, External Consultant, Manchester Interviewee 18, University of Technology, Sydney & EA consultant; Interviewee 19, EA consultant, Ovum Group	Why EA? 1 Research Question Future of EA in HE	5	Skype interview/ University of Bolton/ Oxford Town Cafe Telephone Interview	1 Hour 1.5 Hours 1 Hour 2.5 Hours 1 Hour	Yes No No No No	0
8 Institutions in Total			**18 Interviews in Total**		**23.2 Hours /95, 000 words of text generated from interview transcripts**		

FIGURE 3.1. SNAPSHOT OF INTERVIEW TEMPLATE.

3.8. CHAPTER SUMMARY

This chapter has covered aspects research methods and considered the appropriate methodologies and approach for the study. A philosophical approach was selected in line with the initial research strategy highlighted in Chapter One. The chapter also discussed the benefits of the chosen research strategy and how it fits within the study context. A criteria for case study selection was discussed to justify the HE institutions selection process. The case studies are discussed in detail to provide a basis for further discussions and analysis. Specifically, this chapter has provided a good background into the data collection process. The following chapter provides an analysis of the data collected and a detailed analytical process.

CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

4.0. INTRODUCTION

Chapter Four presents a review of the approach of analysis chosen as appropriate for this study. The chapter includes a sample description of the process undertaken to arrive at key research findings and conclusions. The adoption of an EA Evaluation Framework will guide the rest of the research discussions. The framework will be used to compare and review the case studies individually.

4.1. USING QUALITATIVE ANALYSIS

Data gathered from all four case studies were mainly qualitative data, which included interview transcripts, meeting notes from workshops, focus groups, observations and archived documents from the JISC website. Hence, the data analysis would involve dealing with large volumes of data, which needs to be sorted, indexed and interpreted, not merely to reduce the data but to derive meaningful conclusions (Miles & Huberman, 1994; Denzin & Lincoln, 1994; Ritchie & Lewis, 2003; Flick, 2002; Gibbs, 2007). The approach for data analysis would facilitate understanding of contextual and behavioural patterns associated with the adoption of EA for IS planning and transformation in UK HE institutions. Facts from the data are broken down into manageable pieces, where the researcher sorts and sifts them, searching for types, classes, sequences, processes, patterns or wholes. The aim is to assemble or reconstruct the data in a meaningful fashion. The method of analysis used during data collection includes *direct tape recordings* of the conversations with the participants. The data is processed by full-length transcription of the interview, to have a full record of speech included in the transcripts and further processed by the researcher (Miles & Huberman, 1984). Analysis of qualitative data and especially literary texts should provide similar strength rigour and robustness as positivistic research in academic study. Four main approaches to analysing research data include quasi-

statistical, editing, immersion or crystallisation, and template analysis (Crabtree & Miller, 1992). There are critical issues about research data transcription, either from video or audio recordings to text and typed transcripts (Kvale, 1989). Issues of accuracy, fidelity and true interpretation of interviews, and observations may be incomplete as information about the setting, context, impressions and body language may be excluded (Kvale, 1989; Gibbs, 2007). Otherwise, the value of having a transcript of a research interview is viewed by the researcher as the ability for conduct detailed analysis of interview transcripts, that are easily readable and can be used in a group research setting (Gibbs, 2007). Several notes and excerpts were taken from each session of interviews that were used as codes for identifying patterns in the study. Each interview session helped the researcher identify main themes, issues, problems, and questions surrounding the study. Other documents accessible include minute of meetings, newspapers, journals, public documents, memos and executive summaries. These documents are accessible to the researcher at any time due to availability and they represent verified information that have been compiled by participants or participating institutions. To validate information provided by participants, the researcher could use the documents. These documents express the feelings and views of the institution on the social phenomenon.

4.1.1. QUALITATIVE ANALYTICAL APPROACH

The method for qualitative data analysis the researcher chooses for this study is template analysis, or also identified as thematic analysis. This is an analytic technique commonly used to analyse large textual data, especially in qualitative research by encoding of the data to identify issues and categories emerging (Boyatzis, 1998; Attride-Stirling, 2001; Braun & Clark, 2006; Riessman, 2008). The analytical process involves a systematic and diagrammatic representation of extracted categories of themes. The texts are initially broken down into basic and organised themes, and then summarised as networks under a global theme. The use of Toulmin's argumentation theory that suggests that there is a progression from accepting data as *hard evidence*, through to justifying the text as a *warrant* adequate to make a noteworthy *claim* has been widely discussed as the initial constructs for the approach (Attride-Stirling, 2001). There are six steps typical in using thematic analysis to analyse qualitative research data. They are: *(i) Coding the material, (ii) Identifying the themes, (iii) Constructing the thematic networks, (iv) Describing and exploring the thematic*

networks, (v) Summarising the thematic networks, and (vi) Interpreting the patterns. Thematic analysis also uses illustrations or web-like networks as a system for categorising the data and deducing further claims. Two areas of applications based on the researcher's epistemological stance that favour identifying and applying themes to data may include a '*realist qualitative work'* (Miles & Huberman, 1994), and a '*constructivist contextual work'* (King, 2004). Template analysis makes use of *codes* and *themes* to identify patterns in rich textual data.

4.1.2. THE CODING TEMPLATE

Codes are used to pull together and categorise a series of otherwise discrete events, statements, and observations that the researcher identifies in the data (Charmaz, 1983, p.112). "*A code is label attached to a section of text to index it as relating to a theme or issue in the data which the researcher has identified as important to his or her interpretation*" (King, 2004 cited in Cassell & Symon, 2004, p.257). Template analysis as compared to other analytic techniques allows for codes to be a descriptive as in a phrase or text rather than plain words. A good thematic code should have five elements that describe the richness of the qualitative text: *(i) A code should be a label, (ii) A definition of what the theme concerns, (iii) A description of how to know when the theme occurs, (iv) A description of any qualifications or exclusions to the identification of the theme, (v) Should have both positive and negative factors to eliminate possible confusion when looking for the theme.* Boyatzis (1998) describes two types of codes that can be used during a research analysis, *data-driven and theory-driven codes*. Data-driven codes are constructed inductively from the raw research data. An inductive approach is taken to identify patterns emerging from the research data. This approach has a higher chance of obtaining reliability of analysis because the researcher is closer and interacting with the raw data during the process (Wolcott, 2001). On the other hand, theory-driven code can be defined as appropriate for a critical realist, as an approach to prove a perceived worldview. Theory-driven codes are developed from existing research theories of the worldview, while the research seeks to build or improve them but explaining the occurrences with new evidence (Boyatzis, 1998). In this study, the researcher takes an intermediate approach where the researcher starts out with a set of theory-driven codes with a further combination of data-driven codes added to the final coding template. The theory-driven codes were based on the adopted theoretical framework, and some

refinement after exploration of the research data (Crabtree & Miller, 1992; Waring & Wainwright, 2008). These codes were generated from the research interviews and matched with initial data-driven codes in the adopted framework for comparing EA work (Janssen & Hjort-Madsen, 2007).

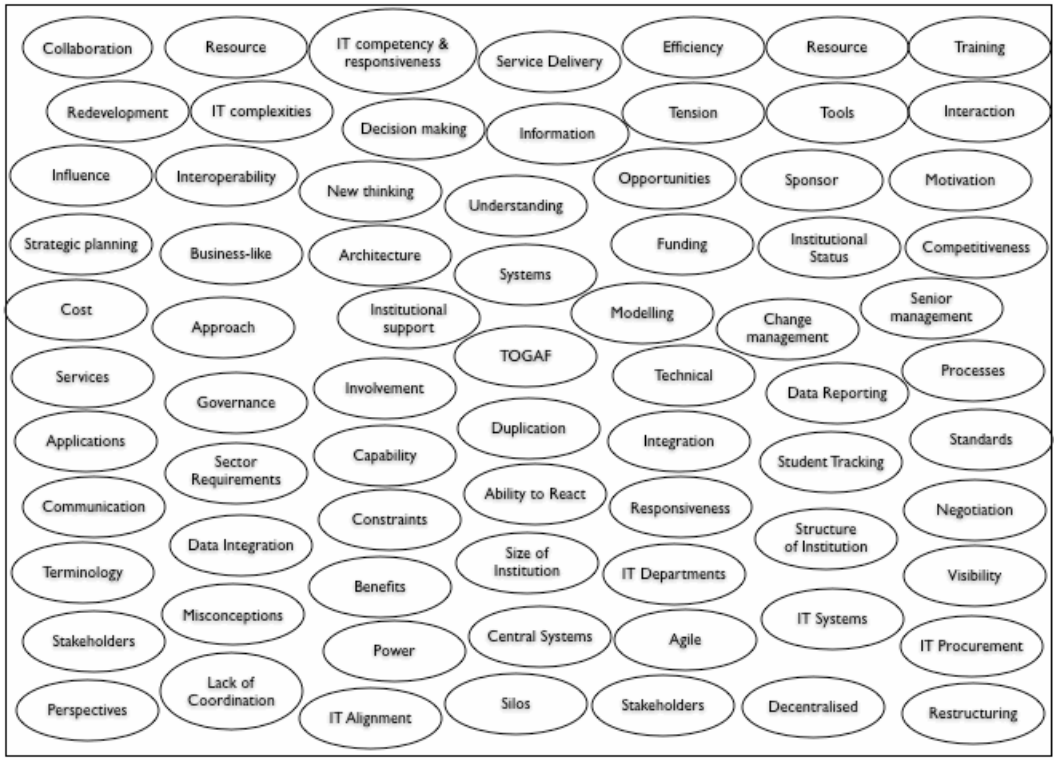

FIGURE 4.1. TEMPLATE FOR RESEARCH CODES GENERATED.

4.1.3. GENERATING RESEARCH THEMES AND TEMPLATES

Thematic analysis is described as a "*recurrent and distinctive features of participants' account, characterising particular perceptions and or experiences, which the researcher sees as relevant to the research question* (King & Horrocks, 2010, p.150). There are obvious advantages and disadvantages of using to interpret research data. Some of the advantages include: *(i) Themes are used in developing templates. These templates enhances the clarity of results and insights of the findings, and eases the communication to a possible audience that includes both positivists and social researchers, (ii) Themes are useful to help check on data reliability, do scoring and scaling, and apply statistical analysis to the determination of validity of the themes and codes.* In contrary, the flexibility of the method with the research data may be viewed as a disadvantage because it allows for a broad range of analytical perspective that can be taken, thereby making it hard to define a focus

early on in the process. Also, thematic analysis has limited interpretive power beyond mere description if it is not used within an existing framework that anchors the analytic claims that are made. A properly conducted analysis using this approach takes more time compared to some other methods (Braun & Clarke, 2008). In addressing some of the concerns associated with using thematic analysis to interpret research data, due care has been taken by the researcher to ensure the themes are relevant and tightly related to the research question. In reminder, the purpose of this research is to understand issues surrounding the adoption of EA in UK universities. Tables 4.2 and 4.3 show snapshots of the research themes generated from the research data. Thematic analysis uses three levels of constructs identified as the basic, organising and global themes. Basic themes are the lowest-order structure of themes generated from the research data. Organising themes are clusters of similar issues identified in the data (Attride-Stirling, 2001). While organising themes together are used to support a claim or argument from the research data. The basic themes were generated from the research data, which were based on the main research questions used during the semi-structured interviews. These were further grouped into organising and global themes. The global themes were grouped accordingly with the elements in the evaluation framework. The research questions used throughout the data collection process are attached in the appendix. There were other issues that were identified during this process. Each of the global theme forms the core of a single thematic network. The thematic networks developed in this study represent the relationships between the basic, organising and global themes. This is shown using a web-like illustration for each global theme, which invariably represents a key factor affecting the adoption of EA, and an element of the EA evaluation framework.

4.1.4. USING A COMPUTER-AIDED ANALYTICAL TOOL

The role of software assistance in the analysis is to assign codes to volume or portion of text during the analysis. The researcher argues that this in no way creates a barrier to a thorough analysis but aids the process due to the high volume of text extracted from the interviews. The use of atlas-ti during the initial coding phase was found to be restricting for the researcher. Hence, the researcher adopted the use of coloured post-it stickers, coloured highlighters, and pens because it enhanced control and intimacy between the researcher and the research data. Some researchers find the use of similar tools as substantial barrier to the getting close to the data (Waring &

Wainwright, 2008). This is true only if the researcher relies solely on the software to identify codes for the process, while the rest of the analysis could be conducted using the tool. The main challenge experienced in the use of the software was the lack of experience in developing codes because the software did not provide any helpful tips. The software could be more useful with a larger dataset. Some researchers prefer to do the analysis manually because of the fear that the software coding could fracture the data too much (Mason, 2002).

4.1.5. CONSTRUCTING THE THEMATIC NETWORKS

The researcher works from the basic themes inwards, to form smaller global themes that illustrate a particular issue. The themes that relate to each other and to a particular global theme were categorised as a thematic network. Three networks were identified for this study, which were related to one of the research objectives and used to uncover other issues in the data pattern. The process of identifying new themes at this stage is very important to the entire research because it highlights new issues that emerge in the adoption of EA in the HE sector. One of the networks represented the drivers and motivation for EA adoption in these institutions. EA adoption in the sector was initially driven by external factors, such as financial incentives, but other motivating factors became apparent. These factors included: *(i) The need to comply with new government policies for data reporting, (ii) As a result of cuts to national budgetary allocations, institutions were driven to review internal spendings, (iii) An increase in senior management demand for improvements of IT service.* The drivers for EA adoption were largely provided by political agenda, government policies, and very little financial incentives in some of the public sector organisations (Janssen & Hjort- Madsen, 2007; Christiansen & Gøtze, 2007). As the HE sector also face similar challenges with improving services to staff and students, institutions need to match the speed required in meeting sector demands and requirements. There is the need to be more responsive (Clark, 1998; Henderson & Venkatraman, 1999). In addressing these demands, institutions need to enhance old and new institutional capabilities to be more agile, adaptive and responsive.

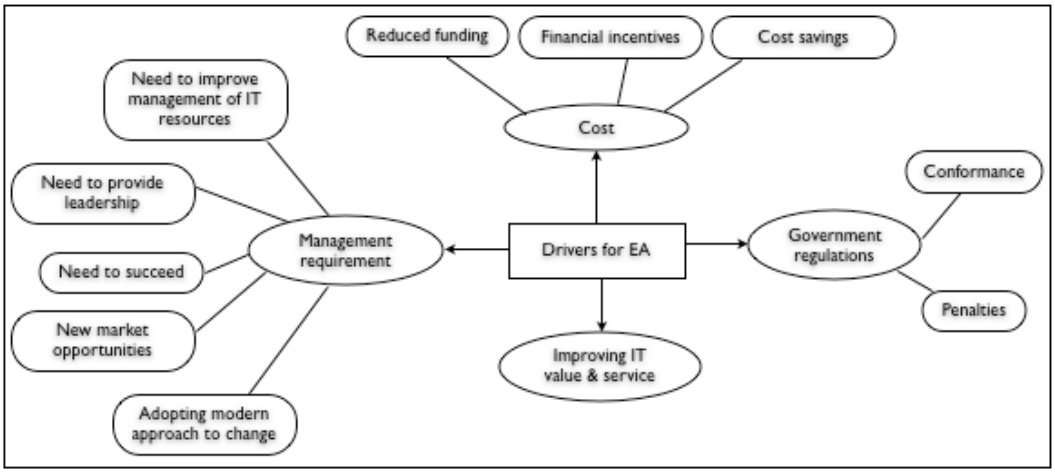

FIGURE 4.2. A THEMATIC NETWORK OF DRIVERS AND MOTIVATION FOR EA.

4.1.6. INTERPRETING THE THEMATIC NETWORK

In this thematic network, three different aspects of costs are identified. *Reduced funding* comes from changes to the government-funding scheme for HE institutions. All institutions were affected from having sizable cuts to government budgets. As a result, some institutions needed to review, consolidate and control institutional spendings (*cost savings*). On the other hand, the JISC funding provided for these institutions in the EA pilot programme was a major influencing factor to adopt the EA practice (*financial incentives*). The use of this network includes to create a flow of thoughts from the respondents using the assigned codes and themes and to bring clarity to the relationship between the need for EA and the actual purpose for adoption without influencing the data in any way.

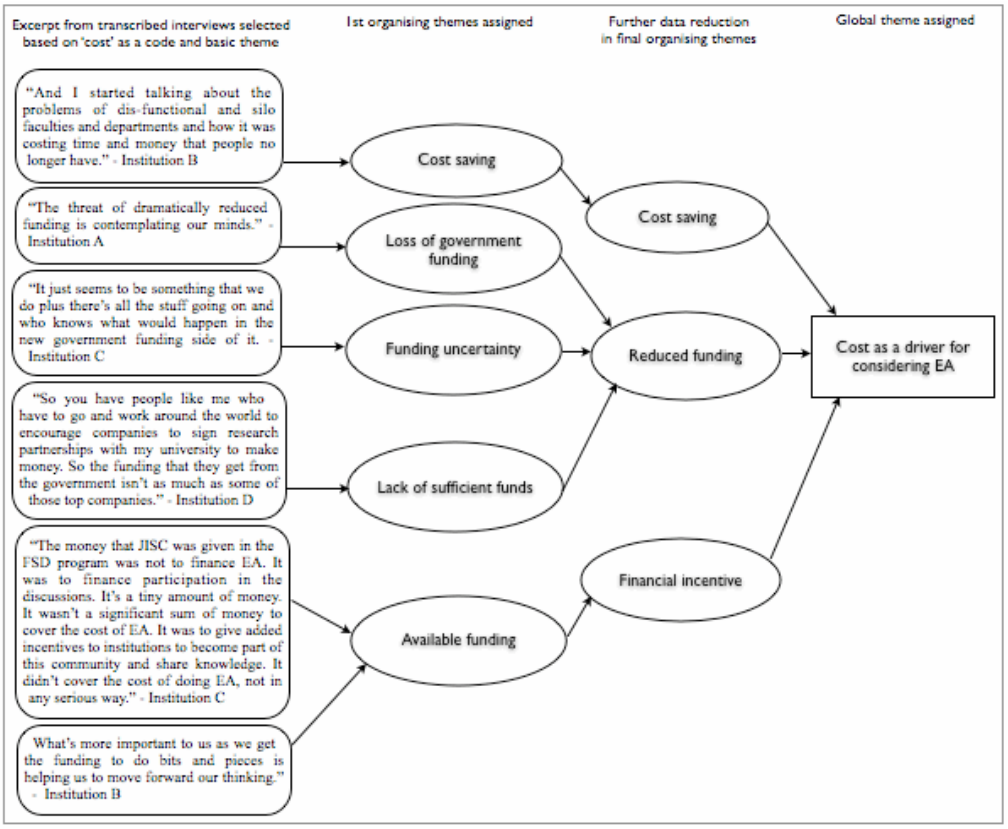

FIGURE 4.3. INTERPRETATION OF A THEMATIC NETWORK.

Figure 4.3. Represents a thematic network for the role of actors as influential people in the institutions and institutional structures that determines EA adoption. The role key individuals play in the adoption process of EA, can either cause the process to succeed; be implemented successfully, or fail, be rejected out rightly from the top or given low priority.

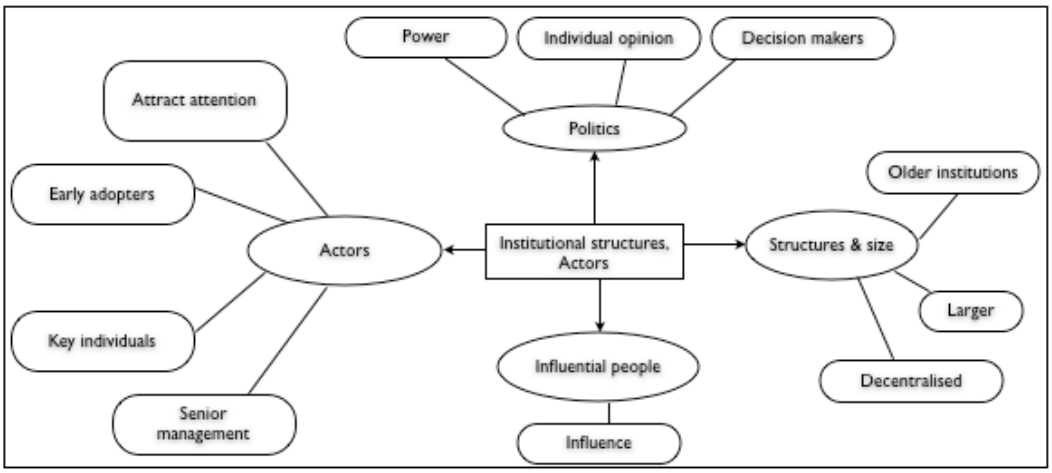

FIGURE 4.4. A THEMATIC NETWORK OF INSTITUTIONAL STRUCTURES & ACTORS.

Members of the institutions who support EA experience limited influence to drive the decision making body to a consensual stance. This shows that there is the lack of key influential EA personnel, who are EA champions and in senior management positions across the institution. Other members of the institution may consider the business case for an EA approach as individual political agenda. They may be viewed as these EA champions desiring decision making influence across the administrative and academic departments of the university. The themes occur across all four institutions. Institutions with a record success of EA adoption have institution-wide support from senior management board, which helped the proliferation of the practice. In one of the participating institution, the key EA champion had left the institution early on in the project start up. Consequently, the adoption was delayed and there was an eventual decline in the enthusiasm about EA. Figure 4.4. Represents the thematic network that explains the relationship between the impact of having key individuals in senior management roles, to drive the adoption.

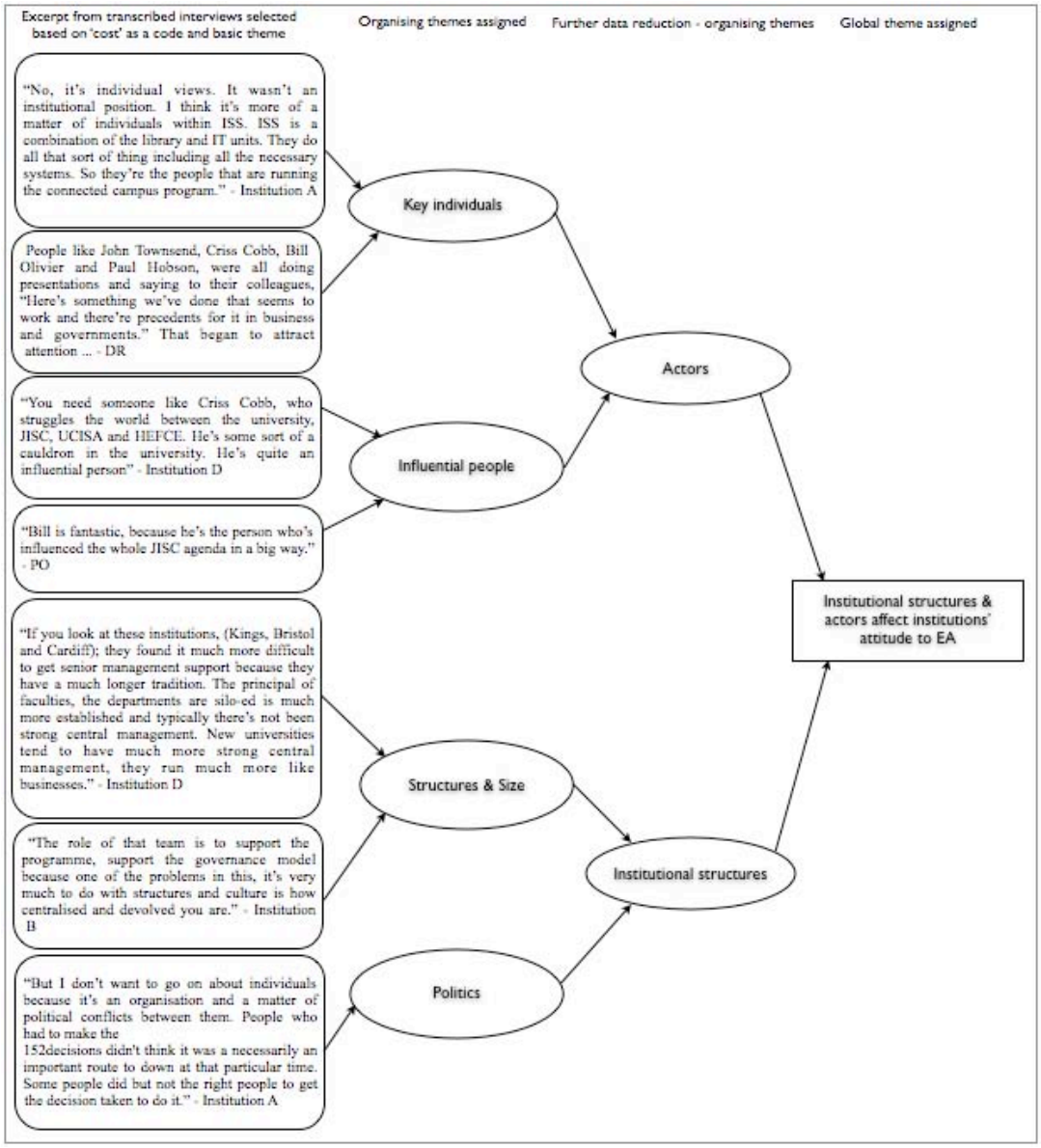

FIGURE 4.5. INTERPRETATION OF A THEMATIC NETWORK.

Table 4.2. Presents a summary of themes that were generated as the global themes, which will be used to analyse the EA programs of the four universities. Table 4.3. Also presents a comparison of the first two existing versions of the framework that are adopted for comparing EA programs in national governments and the modifications generated based on the context of this study.

Global themes	Organising themes
1. Policies, actors, structures & drivers	Influential personnel, Politics, Size of institution, Conformance to government policies, Avoid penalties, Reduced institutional funding from government, Financial incentives from JISC, Need for success, Need to provide leadership, Need to managed new opportunities, Adopting modern approach to change, Need to improve IT management
2. Governance & leadership	Need for IT governance, Lack of IT standards, Poor culture of compliance, Areas of applying governance measures, Need for an IT governance function, Composition and size of existing IT governance group, Responsibility of IT governance group, University status, Lack of awareness, Different institutional drivers, Lack of business motivation
3. Architecture frameworks and models	Time constrains to evaluate frameworks, Framework too complex for institutions
4. Architecture principles and standards	Different types of principles, Better conversations, Data sharing ability, Agree common requirements
5. Implementations	Scope too broad, Lack of IT governance, Lack of IT standards, Lack of suitable tools, Constantly increasing business demands
6. Benefits	Better decision making, Better communication and collaboration, Business engagement with IT, IT synergies and efficiencies, Less complex IT infrastructure, Better project planning
7. Resources	Expensive tools, Expensive consultants, Implementation cost
8. Institutional support	Domain control, Lack of stakeholders' collaboration, Resistance to change, Existing culture
9. Evaluation	Need ways to measure EA value, Value depends on support

TABLE 4.1. THEORY & DATA-DRIVEN THEMES.

Initial Framework Elements (Janssen & Madsen, 2007)	Adopted Framework Elements (Liimatainen, Hoffmann & Heikkila, 2007)	New Extended Framework Elements

Initial Framework Elements (Janssen & Madsen, 2007)	Adopted Framework Elements (Liimatainen, Hoffmann & Heikkila, 2007)	New Extended Framework Elements
Policies, actors and structures	Scope, actors and structures	Policies, actors, structures & drivers
Governance	Governance	Governance & leadership
Architecture frameworks and methodologies	Architecture frameworks and methodologies	Architecture frameworks and methodologies
Architecture principles and standards	Architecture principles and standards	Architecture principles and standards
Implementation	Implementation	Implementation
-	Benefits	Benefits
-	Evaluation	Evaluation
-	-	Resources
-	-	Institutional Support

TABLE 4.2. COMPARISON OF FRAMEWORK ELEMENTS USED IN COMPARING EA PROGRAMS.

Table 4.3. Below defines framework adapted for use in this research.

Elements	Description
Policies, actors and structures	Drivers are defined in the institutional vision, adopted IS planning strategies, the role of actors and organisational structures influencing the EA initiative.
Governance	Governance models and practices that are needed for keeping the architecture practice up-to-date. Covers issues of compliance, behaviours and guidelines for EA.
Architecture frameworks and methodologies	Defines the framework and generic architectural process for the EA work.
Architecture principles and standards	Standards, principles and guidelines used for the implementation and change management.
Implementation	The development processes of EA within institutions.
Benefits	Benefits perceived and achieved from the EA efforts from the experiences of the participating institutions.
Evaluation	Special characteristics, advantages and disadvantages of the EA work in institutions and perceived value of the practice.

TABLE 4.3. THE FRAMEWORK FOR COMPARING EA PROGRAMS (ADAPTED BY LIIMATAINEN, HOFFMANN & HEIKKILA, 2007).

4.2. FRAMEWORK REVIEW

The framework for comparing EA programs is based on a research recently conducted in Denmark and New Zealand (Janssen & Hjort-Madsen, 2007). The framework consists of five elements defining the key issues influencing EA efforts in national government agencies. These elements are used to compare national EA programs in government agencies in some parts of the world. The application of the framework is appropriate to evaluate EA in a similar public sector context. An adapted version of the framework by the Ministry of Finance, under the Finnish Enterprise Architecture Research Project in 2007 includes additional elements, which are, *Benefits* and *Evaluation*. For this study, the additional elements from the FEAR version of the framework are also adapted. Two additional factors that impact the EA programs in these institutions are identified as *(i) Resource,* and *(ii) Institutional support*. The final modification of the framework is used to review and compare the EA program in the UK HE sector. Table 4.5. Presents the final framework for use in this study.

Viewpoint	Description
Policies, actors, structures and drivers	EA drivers are defined in the institutional vision, adopted IS planning strategies, the role of actors and organisational structures influencing the initiative.
Governance and leadership	Governance models and leadership practices that are needed for keeping the architecture practice up-to-date. Covers issues of compliance, behaviours and guidelines for EA.
Architecture frameworks and methodologies	Defines the framework and generic architectural process for the EA work.
Architecture principles and standards	Standards, principles and guidelines used for the implementation and change management.
Implementation	The development processes of EA within institutions.
Benefits	Benefits perceived and achieved from the EA efforts from the experiences of the participating institutions.
Evaluation	Special characteristics, advantages and disadvantages of the EA work in institutions and perceived value of the practice.
Institutional Support	The support requirement provided by the institution constituents and stakeholders.
Resources	The resource requirement for successful EA implementation from within the institution.

TABLE 4.4. THE EA EVALUATION FRAMEWORK (ADAPTED FOR THIS STUDY).

4.2.1. POLICIES, ACTORS, STRUCTURES AND DRIVERS

These describe the high value factors that influence the drive for EA adoption at institutional levels. In public sector agencies, there is the high tendency for EA adoption to be largely motivated by government policies, such as the Clinger-Cohen Act of 1996 in the United States, which helped regulate how public sector organisations acquire, plan and manage their IT investment portfolios. Further institutionalisation of EA in government agencies are also determined by key influential actors and constrained by existing democratic structures (Hjort-Madsen, 2007). The political agenda largely informs the EA vision of each national government program, while; the operational and financial drivers are not major influentials for adoption (Christiansen & Gøtze, 2007). For HE institutions, EA adoption is largely driven by financial incentives and operational objectives than by political goals and or financial objectives in other public and private organisations. Institutions need to ensure the EA vision is clearly defined as short long and or long-term goals, and should be aligned with the greater institutional goals as in other context (Christiansen, 2006). The role of EA champions as influential personnel in senior management cannot be overstated. They mediate between IT and the administrative side of the university because some of the proposed changes may affect institutional structures, governance, and require compliance from different administrative stakeholders. EA should be driven top down, from senior management to lower level management, to ensure adherence and sustainability.

4.2.2. GOVERNANCE AND LEADERSHIP

An IT governance framework ensures specific decision rights and accountabilities of individuals, to encourage desirable behaviour in using IT resources (Weill & Ross, 2004; Hjort-Madsen & Janssen, 2007). While EA standards are effective in helping organisations to better manage their IT resources, ensure successful development, integration and management of an EA vision (Weill & Ross, 2004; Aziz et al. 2005; Boh & Yellin, 2007). Instituting a high level of severity will result in a highly bureaucratic organisation, which limits the ability for individuals to be innovative. A high level of bureaucracy will inhibit the organisation's ability to respond quickly to external changes, demands and pressures for solutions and efficiency. In today's modern business environment, organisations need to be resourceful and innovative. HE institutions have many decision making committees, and often times, high level

IT decisions are taken by nominal senior management committees or individuals. Institutions need to incorporate a leadership role for IT, such as; the role of a CIO in senior management committees, and an EA support office. They will be responsible for three key responsibilities; *(i) To ensure that IT delivery expectations are fulfilled by prioritising projects and IT resources; (ii) IT resources deployment is continuously planned, steered and optimised; and (iii) IT performance is measurable, reliable and risks are minimised.* Without such, EA would remain an ad hoc implementation.

4.2.3. ARCHITECTURE FRAMEWORKS AND METHODOLOGIES

An EA architecture framework is used to organise and manage documentation of tan architecture work, which may include artifacts, models and other descriptions of the organisation. They are also used to describe different abstractions of the enterprise, and to manage the scope of the EA work (Kaisler et al. 2005). EA Frameworks, such as The Open Group Enterprise Architecture Framework (TOGAF) and the Zachman Framework are some of the most common frameworks. They afford a methodical approach to doing EA work (Janssen & Hjort-Madsen, 2007). The adoption of EA frameworks is based on the type of views and levels of abstractions required. The choice of EA frameworks by the institutions in the pilot programme are largely motivated by open standards requirements of the sector, ease and trialability of the Open Group Architecture Framework (JISC TechWatch Report, 2009).

4.2.4. ARCHITECTURE PRINCIPLES AND STANDARDS

Architectural principles and standards guide decisions and compliance measures that are enforced, to ensure that strategic business objectives are met (The Open Group, 2006). Three classifications of principles are: *Enterprise*, *Business*, and *Technology* principles (Stelzer, 2009). Principles guide the designs of technology, data, and processes in organisations (Hoogervorst, 2004; Winter & Fischer, 2007; Schekkerman, 2008). They are derivatives of stakeholders' concerns identified as bottlenecks to the organisation. These agreed principles are used to bridge the gap between high-level strategic objectives and specific concrete designs to ensure that essential system design requirements are met. Concession to these principles by different stakeholders is key to ensuring effectiveness of EA towards steering and coordinating the desired implementations. These principles and agreed standards are

useful in guiding any organisation to better manage the EA work (Weill & Ross, 2004; Boh & Yellin, 2007; Greefhorst & Proper, 2011). HE institutions have adopted some of the open group's architectural principles as, *data principles*, *enterprise architecture principles, project principles, application and technology principles* in the implementation process. Architectural principles should be business-driven and applied from a top down approach to ensure they are relevant and they define functional requirements of the stakeholders. This will encourage a standard way of working across the institution and facilitate quick business decisions. The act of deciding on which principles are relevant to the institutions, are opportunities to encourage conversations between the administrative staff and IT.

4.2.5. IMPLEMENTATION

EA implementation concerns are focussed on the use and translation of the overall planning process involving use of the EA framework, architectural principles, and models towards the realisation of the EA vision (Janssen & Hjort-Madsen, 2007). Many organisations struggle with realising their goal because they lack sufficient knowledge of their architecture and other development issues. Implementation planning is an entirely different process of EA adoption because the use of EA framework categories each phase, and manages the business requirements and stakeholders' involvement (Armour & Kaisler, 2001). There are existing interdependencies between systems, processes and actor roles that should be considered during the design to the development. This does not necessarily require the use of a separate framework because EA is already aimed at supporting strategy implementation through processes, such as, project prioritisation or project portfolio planning processes (Winter & Fischer, 2007). The adoption of EA in some institutions face major concerns, especially at the implementation phase because of the need to gain consensus and commitment across the institution. An effective governance framework will ensure the success of EA implementation phases (Janssen & Hjort-Madsen, 2007).

4.2.6. BENEFITS

Realising benefits from IT requires effective organisation and management skills, so that the potential benefits from the use of IT resources are achievable (Ward & Elvin, 1999). One of the causes for IT *'failure to meet'* business needs are casual effects of unrealistic or unaligned business expectations from IT investment. This

perception that IT usually fails to meet the desired business expectations has led to a high rate of lack of trust in IT and reluctance for senior managements with tight budgets to invest in innovative practices. Some of the perceived value of an EA program include financial gains, operational efficiencies including improved user-services, systems integration, better project portfolio management, and improved alignment of IT decisions with strategic goals. Both tangible and intangible benefits should be measurable, although intangible benefits are difficult to measure over a short period (Rico, 2005; Christiansen, 2006). As much as efficiency gains are equally valuable a successful EA programme should include benefits in multiple areas (Rico, 2005). Typical examples of the value of EA work in e-government initiatives include; financial, economic development, reduced redundancy, fostering democratic principles and improved user services (IAB, 2003; Liimatainen et al. 2007). For successful consideration of adoption of EA, it is important to include cost value to the business case for EA (Frambach & Schillewaert, 2002).

4.2.7. EVALUATION

Assessing the impact of a technique is critical for continuous improvement (Premkumar & King, 1991; Teo & King, 1996). The evaluation process compares EA programs across different institutions, to educate institutions on the prospects of an EA program and adopt best practices. Aspects to focus when evaluating EA programs should include: *(i) Understanding perceived benefits; (ii) Articulating the achieved benefits; (iii) Evaluating stakeholder satisfaction during and after implementation; (iv) Assessing the impact on the business; (v) Ensuring original EA vision is consistent with the business goals, and (v) confirming that each phase is allocated appropriate timing*. A continuous evaluation of EA is prerequisite to ensure appropriate improvements to its standards (Liimatainen et al. 2007; Liimatainen, 2008). Subsequently, constant evaluation of the EA programs in the institutions would ensure that the processes are reflected upon.

4.2.8. INSTITUTIONAL SUPPORT

Gaining organisational support and commitment to an adoption process largely influences its success or failure (Pinto & Slevin, 1987; Jarvenpaa & Alves, 1991; Somers & Nelson, 2001). It is necessary to secure full senior management support and commitment from various stakeholders from the initiation of the process (Holland et al. 1999; Sumner, 1999; Teo & Ang, 2001). Institutional support includes

senior management support (allocation of budget and personnel resources) and stakeholder commitment to the program. An EA program needs to be supported at various stakeholder level involving collaboration from business managers, heads of departments, and users (Aziz et al. 2005). Institutional support can be driven from IT via a *bottom up* approach, from senior management via a *top down* approach or preferably, an application of both using a *middle out* approach, to ensure effective diffusion across the institution.

4.2.9. RESOURCES

Ensuring that there is allocated resource for the EA program is a key part of the planning stage and important for successful completion of the architecture (Wagter et al. 2005). Establishing an EA team may be unrealistic for some small-scale organisations or universities. The EA team will be responsible for managing different stakeholders and developing the architecture. The team members collaborate the stakeholders to identify business requirements and facilitate the process of decision-making by senior management (Aziz et al. 2005). Resources required for any EA program includes a right mix the following: *(i) Staffing and time commitments; (ii) Funding for staff training and development; and (iii) Advanced expertise, such as, external consultants*. These factors are of minimal concern for large corporate organisations because they are able to dedicate large resources, with specific responsibilities for managing the architecture work. Supplementing the work with external consultants is essential for small-scale organisations, to provide start up assistance to the teams (Sumner, 1999). Experienced consultants bring a wealth of knowledge to the organisations and they are able to diagnose and suggest quick solutions as outsiders.

4.3. USING THE FRAMEWORK TO COMPARE INSTITUTIONAL EA PROGRAMS

This section presents a review and comparison of the four EA programs in the various institutions.

4.3.1. KEAP, INSTITUTION A

4.3.1.1. POLICIES, ACTORS, STRUCTURES AND DRIVERS

The drive to improve existing IS structures, to support flexible and advanced technologies for teaching and research largely motivates this EA initiative. The institutional plan is to have an integrated e-infrastructure as a framework to support teaching, research and administration. In 2006, the institution conducted a review of its then current IT infrastructure, to determine the capability of supporting its overall strategic goal. The Information Systems and Services (ISS) plan identified the need to update most of its systems infrastructure and build further capabilities for integration, to access systems across its colleges. The potential benefit of the plan includes better streamlined administrative and student processes, infrastructure and space reduction, and the long-term goal in reducing overhead costs in systems procurement. The decision to use EA will facilitate the process moving from systems to service-based service provisions. Using EA to capture a wider perspectives and a current state of the number of applications and their dependencies within the research domain. This would facilitate the process to articulate the desired state and the transitions between them. The decision to adopt was driven by two senior members of the institution but was laterally affected by personnel availability.

Supporting evidence - See Appendix	Origin
"It was more of individual views. It wasn't an institutional position. It's more of a matter of individuals within the unit."	Carl-R5
"To be frank, it's really a matter of politics between them. People who had to make the decisions didn't think it was necessarily an important route to take at that particular time."	Carl-R6
"Some people did take on board the idea, but it wasn't the right people who could get the decision to adopt at very senior level. We need to have people who are authorised at reasonably high levels. That's pretty the most important thing for us. We need buy-in at significantly high level of management."	Carl-R20

4.3.1.2. GOVERNANCE AND LEADERSHIP

The ISS team is responsible for the overall leadership on IS decisions, to ensure consistency with institutional goals. The Project Office manages IT projects and is responsible to the ISS team. The Executive Steering Group is responsible for managing the Connected Campus (CC) initiative, which includes coordinating progress and timelines. A lower level task force group is set up to coordinate the various projects within the Centre for e-Research (CeRch), where the KEAP project is situated. There are identified disparities between the governance structures, which may strengthen the business case for EA governance as a committee structure that manages the architecture work. The constitution of the committee would be of upmost concern, where there the committee members should be substantially influential within senior management groups.

Supporting evidence - See Appendix	Origin
"We're not so much involved in a central governance kind of thing."	Carl-R13

4.3.1.3. ARCHITECTURE FRAMEWORKS AND METHODOLOGIES

Architecture Principles and Standards guides the implementation process to ensure conformance to architectural standards among all EA initiatives. These are applicable across national programme such as the European Interoperability Framework (EIF). The use of TOGAF was largely encouraged among the institutions because of its alignment with sector needs for open sourced interoperability models and frameworks.

Supporting evidence - See Appendix	Origin
"We did not find TOGAF itself highly useful except as a broad framework and vocabulary for representing our architectural work."	John-R5

4.3.1.4. ARCHITECTURE PRINCIPLES AND STANDARDS

The principles and standards guiding this initiative are defined at a preliminary phase. There were no requirements to review the principles; hence existing standards were maintained in the interim. The KEAP project was initially broken down into three stages to fit within one complete cycle of the (Architecture Development Method) ADM, under The Open Group Architecture Framework.

Supporting evidence - See Appendix	Origin
"Our approach was to look at the specific requirements from TOGAF and produce a more generic architecture from that. We've abstracted the common principles and requirements for our architecture development."	John-R6

4.3.1.5. IMPLEMENTATION

The requirements management requires interaction with other departments and stakeholders, to ensure their concerns and needs are addressed. As the IT function is viewed more as Solution function than from a business perspective, EA requires more effort to gain buy-in from the different stakeholders including the technical team. The reason include the fact that EA is more externally funded; hence a low stake and drive for collaboration in the investment. If a business case is presented that links directly with one of the priority areas of the institution and driven in a *top down* approach, then there is likelihood for success.

Supporting evidence - See Appendix	Origin
"We're funded entirely by external projects. If we were interested in normal IT departments, we wouldn't be funded by projects; we'll be funded by the institution."	Carl-R15
"We do have difficulties when we have to interact with people and work with systems outside our domain."	Carl-R15

4.3.1.6. BENEFITS

The success of the EA program could be not articulated at this stage, but there was a strategy to sell the benefits to gain further buy-in from an institutional perspective.

Supporting evidence - See Appendix	Origin
"Originally, when we started off, our idea was that we would demonstrate the usefulness of doing projects within our particular area, in view to push out the idea and get it adopted elsewhere within the institution or at a higher level."	Carl-R2

4.3.1.7. EVALUATION

The institution was more focussed on getting buy-in across the institution, and doing the work. There was no need at this stage to evaluate or measure the benefits of EA to the institution.

Supporting evidence - See Appendix	Origin
"We're still carrying on this approach in a pragmatic and practical way within the areas that are within our jurisdiction. I think it will survive in some form, but I think it needs to be approached pragmatically rather than by projects that aren't theoretically fashionable."	Carl-R3
"I don't think it makes sense to do it at the sort of level we're doing it. I think of it as guerrilla EA."	Carl-R3

4.3.1.8. INSTITUTIONAL SUPPORT

The EA team lacked full senior management support, which could be attributed to reasons such as project portfolio prioritisation.

Supporting evidence - See Appendix	Origin
"We're a bit conservative and non-receptive when it comes to new ideas. So we didn't have much joy with the project within the short time scale because people were also busy with other things."	Carl-R4
"We also planned to encourage the adoption of an EA approach more widely within the College, as we observed that, although we gained benefit from doing EA within the research domain, it might have been more beneficial at an institutional level, due to mutual dependencies between domains within the College."	John-R8

4.3.1.9. RESOURCES

There was a team, which consisted of a maximum of two members responsible for liaising with different stakeholders and developing the architectures. Members of the EA team also needed to develop new skills for EA modelling because the EA modelling tools were advanced.

Supporting evidence - See Appendix	Origin
"I wouldn't like to quantify our EA efforts now because we haven't such a team. We should have a team who are at least dedicated to it. We could do with more resources but specifically to do EA."	Carl-R9
"There were issues about both human and capital resource availability and allocation. They didn't think it was the most important thing to do with what resources were available at the moment."	Carl-R10
"We had a separate group whose responsibility it was to liaise with these different stakeholders and we had the ear of people quite high up in management."	John-R10

4.3.2. LEAP, INSTITUTION B

4.3.2.1. POLICIES, ACTORS, STRUCTURES AND DRIVERS

The university's IS strategy includes to reduce its IS portfolio to a manageable number of core projects by streamlining to a standardised infrastructure platform, to reduce data duplication and meet integration requirements. The standard infrastructure platform is achieved through the implementation of Oracle's eBusiness Suite by deploying a couple of Oracle's systems including, Oracle Student System (OSS), the Blackboard VLE, Customer Relationship Management (CRM) for recruitment and clearing, student welfare and complaints, Oracle Human Resource and Payroll, Balanced Scorecard Performance Management System, and the Oracle Campus Solutions. EA adoption supports the earlier institutional goal and initiative to improve its IS architecture, governance and add new flexibility to its technical web services. Thus, the use of EA is largely driven by the need to understand and simplify the complexities of having multiple business systems and processes.

Supporting evidence - See Appendix	Origin
"It's quite key that the Financial Director is the senior person in the project because to an extent it depends on who the individuals are."	Paul-R12

4.3.2.2. GOVERNANCE AND LEADERSHIP

The university's technology governance structure is based on the IT Governance Model giving the rights and responsibility of IT decisions and management to the IT function. (Weill & Ross, 2004). Recently, the university reviewed its governance framework using the Information Systems Management and Governance Toolkit (ISMG). The Information Management Steering Group (IMSG) has responsibility for defining institutional Principles for Architecture work and to ensure departmental compliance. Projects are managed using PRINCE2 project approach and the Managing Successful Programmes (MSP) frameworks. The current Chief Information Officer (CIO) reports directly to the Pro Vice Chancellor for Finance, Planning, and Information. The CIO is responsible for information, program and change management, EA policies and principles and IT investments.

Supporting evidence - See Appendix	Origin
"So the fact that different departments have their funds doesn't mean they can buy what they want. They still have to put forward a business case that goes through the development programme steering group. If approved, then they can do it but report through the steering group."	Paul-R8

4.3.2.3. ARCHITECTURE FRAMEWORKS AND METHODOLOGIES

Supporting evidence - See Appendix	Origin
"We're doing balanced scorecard, we're doing program management and there's big pieces of those that are also in TOGAF. So we weren't going to throw those away. So the way that we approached the TOGAF stuff, is that when you look at the ADM, the lifecycle; is which bit of that are we doing and then swap them in."	Paul-R16

4.3.2.4. ARCHITECTURAL PRINCIPLES AND STANDARDS

The institution's IS/IT principles are adopted from the Open Group and they define how information is created, used, accessed, and stored. The principles are also used as a basis for instituting a standard data definition and a common language vocabulary. They are managed by the development programme committee and used to ensure compliance, data sharing, integration and collaboration across departments.

Supporting evidence - See Appendix	Origin
"So then having that principle is useful if it's agreed at the senior management level." *"We've adopted an Information Management and Governance Structure, which is a mechanism for ensuring that we do with ICT supports the organisational vision and objectives. It's a major change within the institution at the moment but the change raises the profile of EA"*	Paul-R21

4.3.2.5. IMPLEMENTATION

Implementation of EA work in this institution is supported by a *top down* approach and is supported by senior management. Implementation focuses on high priority areas, which receives cooperation from all stakeholders.

Supporting evidence - See Appendix	Origin
"We only do EA where there is a business problem that it would help with." *"Our focus is centred around doing 'just enough' EA and not a huge project in itself."* *"We did have one project but dropped another, which was the SharePoint one. The project manager wanted it to go through the development programme because that gave it the profile that it wouldn't have otherwise."*	Paul-R23

4.3.2.6. BENEFITS

Types of EA benefit the institution achieves include the ability to engage different business stakeholders in conversations and negotiate better business solutions, by providing them with a better understanding of the impacts of decisions taken in isolation and without an understanding of existing dependencies. The institution is able to encourage business users from thinking in systems perspective to service oriented thinking. There is a sense of belief within the institution that there will be cost savings and improved services for staff and students in the future.

Supporting evidence - See Appendix	Origin
"I think it's very difficult to prove any tangible benefit yet." *"There're many-to-many relationships between a range of things the university does to improve student retention. It's very hard to demonstrate that casual relationship or single out EA, to say if we hadn't done this, we wouldn't have gotten this result."*	Paul-R27
"In solving problems really, we've been able to use the models to help with tricky and complex situations." *"I think the benefit to us is that people are able to see the visualisation and you don't have to have big in-depth discussions."*	Ana-R5

4.3.2.7. EVALUATION

This institution highlights some success in their adoption of EA technique because of the favourable disposition from senior management and other stakeholders.

Supporting evidence - See Appendix	Origin
"We've met the objectives of the EA pilot programme and it's continuing to do so." *"So now, people have got EA in their job descriptions and it's built into what they do."*	Paul-R33

4.3.2.8. INSTITUTIONAL SUPPORT

EA approach in the institution is a *top down* approach, which largely contributes to success of the overall adoption. The institutional approach for EA work must satisfy the requirements of the 4Ps, stating that: *(i) EA is relevant and adds value where it can contribute to the resolution of a significant business problem (Problem-based); (ii) EA is not a project in itself, but is an essential component of all IS projects (Project-based); (iii) EA work is managed at the Programme level and is coordinated by the Programme Office (Programme-based); and (iv) EA work is kept*

as simple and minimal as possible to fit the institution and be comprehensible by the business (Pragmatic). At the solution phase, a few difficulties were encountered

Supporting evidence - See Appendix	Origin
"The people who are implementing those systems are focused on getting the systems to work, not on the architecture work. They're obviously under a lot of pressure; so won't sit down in three-hours-long meeting to discuss how different bits relate to each other. That makes it difficult for us to use EA."	Ana-R9

4.3.2.9. RESOURCES

The programme office has a program manager and four business analysts, who support process review work using the EA and report directly to the CIO. Other responsibilities include gathering requirements, collaborating with stakeholders and developing the architecture. The institution also employed the services of an external consulting firm. One of the main difficulties was in issue of re-licensing for the modelling tool, which was initially affordable.

Supporting evidence - See Appendix	Origin
"For us, resourcing is one of the biggest problems; it's having people to do EA as a support function. We could do with more resources but specifically to do EA." *"It wouldn't have been possible to put together a new team. What I learnt to put together a team broadly on the basis that we needed more support change management. This would then involve adopting a number of tools for project management review and EA. So, it's incorporated within that."* *" The BiZZdesign Architect tool includes a repository for EA artifacts but the training is expensive for us."*	Paul-R44
"At the moment, it's just me because the rest of the team are quite new and they need training."	Ana-R10

4.3.3. LEANEA, INSTITUTION C

An interview with the key lead and EA Champion in this institution could not be completed. An earlier Skype interview was postponed as the participant was away on a business trip and the interview could not be rescheduled. The report of the institution presented here is based on an executive summary of the EA pilot programme submitted to the JISC in 2009.

4.3.3.1. POLICIES, ACTORS, STRUCTURES AND DRIVERS

The Information Service Directorate is responsible for the Institutional Strategy Development, Implementation and Technical Infrastructure Development. The Directorate also manages IS and its integration with a service-based strategy. Their aim is to facilitate to an integrated IT infrastructure, systems efficiencies and eliminate duplicated systems functionalities. The goal for EA was to align with the strategic vision of MWE; its Modern Working Environment programme, which includes to coordinate business process automation, application integration and data management. The role of key influential individuals largely affected success of the EA work.

4.3.3.2. GOVERNANCE AND LEADERSHIP

IT Governance within the institution is managed by a steering group, which has members of senior management. Their responsibilities include assessment of project proposals and monitoring solutions delivery. Governance for the LeanEA project is situated under the Modern Working Environment (MWE) programme of the institution. The Project Management Framework is designed to guide and implement project proposals.

4.3.3.3. ARCHITECTURAL FRAMEWORKS AND METHODOLOGIES

The institution had initially adopted from earlier projects using the Zachman Framework but TOGAF was adopted because of the project constrains.

4.3.3.4. ARCHITECTURAL PRINCIPLES AND STANDARDS

There was no mention of Architecture principles and standards that were adopted during the project. The assumption would be that TOGAF principles and standards were adopted based on industry requirements.

4.3.3.5. IMPLEMENTATION

It was focussed on the first four phases of the ADM with focus on the business, applications, and technology architectures.

4.3.3.6. BENEFITS

There were no identified benefits articulated during the program but the EA approach to process review and improvement was not entirely new to the institution.

4.3.3.7. EVALUATION

There were existing practices such as, LEAN that formed a part of the review processes, but there were no evaluation practices that were adopted for EA review.

4.3.3.8. INSTITUTIONAL SUPPORT

There was need for senior management support and engagement with other key stakeholders.

4.3.3.9. RESOURCES

The institution has a team of business modellers trained to use modelling tools such as, Microsoft Visio, OmniGraffle and IHMC Concept Mapping. The team also uses IBM System Architect tool for other process modelling.

4.3.4. CAIRO, INSTITUTION D

4.3.4.1. POLICIES, ACTORS, STRUCTURES AND DRIVERS

This institution has a collegiate structure with four other colleges. There is an undocumented strategic plan that is focussed on building agility and modularisation into its applications and technology infrastructure. This is a five-year technology roadmap and includes an end-to-end connectivity between systems across various departments and eliminates point solutions in existence by creating enterprise bus services. CAIRO project aims to build an applications portfolio that provides integrated services across the institution and carry out several business process reviews. The project has the support of key influential individuals in senior management to influence the decision making process for IT change and investments.

Supporting evidence - See Appendix	Origin
"EA for us is about changing the emphasis of fitting or agreeing to projects strategically or taking on projects from a strategic context according to a set of principles and a vision to keep those projects in line with the IT vision." *"At management level, there're really only two people; the Pro Vice Chancellor and the Director of IT who knows enough about EA and talking about it to contribute to it."* *"Our Pro Vice Chancellor is quite a switched-on guy. You need someone like him who shuttles the world between the University and JISC, UCISA and HEFCE, and he's quite an influential person."*	Mike-R2

4.3.4.2. GOVERNANCE AND LEADERSHIP

An IT Governance structure, which comprise of a senior management supports the work for the CAIRO project. A review team is responsible for the outputs to ensure consistency over set objectives and timescales of the project. Initial adoption of architecture principles had failed because of strong and effective governance structure. One of the indicators showed that the failure was due to the lead role of IT in business change and transformation for the institution. The IT Governance structure composed of stakeholders from different departments. It was challenging to continuously keep the different stakeholder groups interested and engaged.

Supporting evidence - See Appendix	Origin
"It was brought into the University to try to give the business community a chance to lead from their requirements. *"We've only ever in the last 18 months refused one project. The decision was based because it didn't fit with our EA framework, but that probably isn't good enough. That probably isn't the level of effective governance really."*	Mike-R7

4.3.4.3. ARCHITECTURAL FRAMEWORKS AND METHODOLOGIES

The use of TOGAF ADM and ArchiMate modelling language will ensure continuity of existing implementation standards within the institution. TOGAF as a methodical approach supports the institutional view of doing things in a systematic way and from a *top down* approach.

4.3.4.4. ARCHITECTURAL PRINCIPLES AND STANDARDS

The approach is to reuse the data principles of the SOA within the project, which would ensure compliance from all projects owners and reduce the existing complex systems architecture. The institution intends to use a single vendor, to encourage standardisation and data sharing ability across the departments. Project owners ensure that their projects align with the institutional objectives; hence they liaise with the business analysis team (who manage the EA), to redefine their project plan.

Supporting evidence - See Appendix	Origin
"We defined our principles and we're taking on projects that fit those principles. We're controlling what projects are coming in and saying no to those projects because they don't fit the principles."	Mike-R8

4.3.4.5. IMPLEMENTATION

The plan is to build systems to adapt to the existing processes instead of redesigning the processes to adapt to existing systems. Thus, project owners work closely with tool vendors, to ensure suitable contractual agreements are negotiated. Hence, the actual implementation is delayed until such agreements can be met with the vendors.

Supporting evidence - See Appendix	Origin
"Our problem is not one of convincing people; our problem is actually, doing the architecture."	Mike-R10

4.3.4.6. BENEFITS

The type of benefits the institution can attribute to the existing EA work include; (i) A clearer roadmap and institutionalised data principles; (ii) Development of the EA repository, although sporadic and technical; (iii) Improved change-impact assessments; (iv) More coordinated projects, and less one-off procurement of IT systems; (v) Better processes.

Supporting evidence - See Appendix	Origin
"They can see that this process is better; they can better change the business processes and see where the problems are."	Mike-R22

4.3.4.7. EVALUATION

The project focussed on the review of the attendance monitoring processes with a goal to improve the student retention rate. There was no defined approach to evaluating or measuring the EA work, because it wasn't anticipated in the programme.

Supporting evidence - See Appendix	Origin
"It's very difficult to evaluate our EA effort at the moment; we've only completed this one project, although we can say it worked very well." *"We haven't been very demanding in EA way the first time around because we haven't had the governance or the level of experience required."* *"The tangible benefits are really very, very hard to pull out because I think the whole thing is far from proved."*	Mike-R24

4.3.4.8. INSTITUTIONAL SUPPORT

Lack of continuous support from key stakeholders poses a problem to the adoption process, as there needs to be a good level of consensus before embarking on any amount of change.

Supporting evidence - See Appendix	Origin
"It's not been the greatest of experiences trying to keep the various substantial stakeholders involved. It has been really difficult and probably remains a big problem."	Mike-R15

4.3.4.9. RESOURCES

The university benefits from a team of staff trained to use TOGAF, a small number of business analysts who are also trained and tasked with the responsibility for managing the EA work, which includes EA modelling and maintenance of the repository.

Supporting evidence - See Appendix	Origin
"The actual application of EA was carried out by a small team; a business analysis team." *"We did make use of the JISC shillings. We trained four people in TOGAF properly."*	Mike-R26

4.4. CASE STUDY EVALUATION (SUMMARY)

This section shows a summary of the framework viewpoints of EA adoption by each institution.

Institutions/ Viewpoints	KEAP
Policies, actors, structures & Drivers	Large, traditional and decentralised. EA is applied at departmental level with a wider vision to move from systems to service approach. EA vision is to improve IS effectiveness for research students. Bottom-up approach but approved by senior management but partially supported across the institution. Largely influenced by key individual perceptions. EA adoption is driven by financial incentives and operational objectives.
Governance & Leadership	IS decisions are taken top-down. An initial attempt to have a central IT governance structure proved difficult due to inconsistencies. No separate EA governance structure was created. No set principles were adopted to guide decisions taken or the to guide the EA work.
EA Frameworks and models	The use of TOGAF was too heavy-handed for small projects.

Institutions/ Viewpoints	KEAP
Architecture principles and standards	Use of defined principles at preliminary stages by the EA team at the departmental level.
Implementation	Implementation of adopted principles required further collaboration beyond the department, which was difficult to achieve. Difficult to progress with EA work on an institutional wider scope.
Benefits	Achieved initial benefits to support research students with a more effective data structure.
Institutional Support	Lacked full senior management support because of its conservatism (cautious about change and innovation).
Resources	Lacked sufficient staff resource to do EA. No external consultants were employed. Staff not EA or TOGAF certified.
Evaluation	Issues around EA terminology were mentioned. EA work is still constrained with the department. Staff dissatisfied with progress rate, pursuing top management buy-in. Identified the need to link EA with key institutional projects.

TABLE 4.5. EA EVALUATION FOR KEAP.

Institutions/ Viewpoints	LEAP
Policies, Scope, actors, structures & Drivers	Modern university with centralised governance structure. EA is applied institution-wide. Vision includes to understand the processes and systems , and to simplify the IT infrastructure to ensure easy integration and standardisation. Top down approach and defined as a corporate vision across all levels of management. EA adoption is driven by institutional objective to be service-oriented and largely financially motivated.
Governance & Leadership	IS decision-making is led by the central governance body with substantial IT knowledge and experience. Governance body has a good mix of key stakeholders and Directors from different business areas. Decisions are taken based on business needs. New EA governance structure was created that fits within the broader IT governance.
EA Frameworks and models	Adopted TOGAF, Triaster and Bizzdesign for EA modelling.
Architecture principles and standards	Adopted 10 key information management principles for IS/IT requirements from the Open Group Architecture Framework, which guides IT decision-making.

Institutions/ Viewpoints	LEAP
Implementation	Principles were adhered with exceptions to a few business needs. Took two years to fully embed the principles as standard practices.
Benefits	Difficulty in articulating any tangible benefits, although there were substantial evidences of intangible benefits. These included the ability to negotiate better IT solutions with key business stakeholders. Recent adoption of a benefit realisation framework to measure EA benefits.
Institutional Support	Has full commitment from senior management. Key EA champions have access to senior management members.
Resources	Initially, there was insufficient personnel time availability as they had other roles and responsibilities. Training was provided to two personnel with business analysis background. Additional funding was provided more personnel to be trained. External EA experts were employed at the initial stages to kick-start the work. One staff certified in TOGAF.
Evaluation	Growing interest and use of EA within the institution as a standard practice. Top-down approach has been highly successful; although the success of the current IS structure is not attributed solely to the adoption of EA but the combination of other good practices such as programme management and ITIL. EA is tied to overall institutional objectives.

TABLE 4.6. EA EVALUATION FOR LEAP.

Institutions/ Viewpoints	LEAN EA
Policies, Scope, actors, structures & Drivers	Large, traditional and decentralised institutional structures. Initial EA vision was part of a wider institutional programme. The decision was to apply LEAN concepts to process improvement and EA to process consolidation and information services. Adopted a bottom up approach to EA with plans to broaden the scope of work. Also adopted a systems service approach towards IT integration infrastructure to improve efficiencies and reduce redundancies. EA adoption is driven by financial motivation and the institutional need to reduce silos. Had a key champion at middle level management who later left the institution. No key influential personnel at senior management level (at the Steering Group close to the VC) sustained the work.
Governance & Leadership	Existing IT governance structure for the institution-wide programme provided governance for EA. There were also several IT governance practices within smaller projects. No separate EA governance structure was created.
EA Frameworks and models	Adopted TOGAF but little work was conducted.

Institutions/ Viewpoints	LEAN EA
Architecture principles and standards	There was no mention of any EA principles or standards, but the adoption of TOGAF may suggest the use of its architecture principles.
Implementation	The use of service-oriented approach was encouraged during the implementation stage but not adopted institution-wide. The EA work was constrained by concerns of other key stakeholders, and remained at a very low level.
Benefits	Benefits that were perceived as being achieved included the knowledge gained understanding EA at the training attended and the use of EA modelling practices to review existing business processes.
Institutional Support	Had senior management approval at inception but the EA work was de-prioritised to a less strategic business need.
Resources	Lacked personnel resource for the EA work because there were other projects running concurrently. The team lacked confidence in EA skills. Members of the team were not trained up to professional levels and no external consultants were identified.
Evaluation	Initial proposal for WA work was not fully understood. This affected directly, the full commitment and support by other key stakeholders. It was difficult to recommend EA as a valuable practice to senior management because the work conducted was at a less strategic value. The number of dispersed projects running concurrently discouraged the team. It was difficult to collaborate with other stakeholders.

TABLE 4.7. EA EVALUATION FOR LEAN EA.

Institutions/Viewpoints	CAIRO
Policies, Scope, actors, structures & Drivers	Post-92 institution recently merged with four constituent member colleges. Centralised management structure. EA vision included the need to build an application portfolio that provides integrated business services across the institution. Focused on key strategic projects. Top down approach. EA adoption is largely driven by financial incentives and strategic institutional objectives. Had two key EA champions at senior and middle level management.
Governance & Leadership	Has a Project Implementation Board with constituent members including senior Directors and key business stakeholders. They oversee project outcomes and timescales. Had some inconsistencies with the decisions already taken by the existing IT board. A recent proposal for the creation of a separate EA governance structure was submitted.
EA Frameworks and models	The use of TOGAF was too heavy-handed for small projects.

Institutions/Viewpoints	CAIRO
Architecture principles and standards	Service oriented approach and principles were adopted at the onset. A new set of application and project principles were agreed upon to encourage reuse, integration and data sharing between departments.
Implementation	Projects owner were encouraged to align with the principles. This compliance ensured that vendors and suppliers were flexible in drawing out contractual agreements. Despite these initial successes, further compliance measures were lessened. This was attributed to old cultural practices and the lack of a strong IT governance structure.
Benefits	Benefits achieved included the adoption of architecture principles, the development of an IT roadmap, an EA repository, change-impact assessments and fewer projects undertaken independently. There was better collaboration between the business and business analysis team, who were responsible for managing the EA work. They assisted project owners to align their project to fit within the broader institutional vision, thereby providing better IT support to the business.
Institutional Support	EA is championed at senior management levels but is currently at risk with the likely departure of such key personnel.
Resources	Has a team responsible for business analysis, who are also help the design and implementation for the EA work. Team members are trained at professional levels although none are certified. No external expert services were employed.
Evaluation	EA has only being applied on one project at the time of this report. This was attributed to the lack of motivation and drive from senior management.

TABLE 4.8. EA EVALUATION FOR CAIRO.

4.5. RESTRUCTURING FOR EA IN INSTITUTIONS

4.5.1. EA LEADERSHIP.

In order for EA to be successful, universities need to have good management, understanding and coordination of existing initiatives. The federated and devolved nature of some universities makes the application of EA more difficult as there are often distinct governance challenges. It may be that the commercial and business sectors are more able to establish EA because employees can be more directly encouraged to adopt consistent and uniform practices. Strong top down leadership that can unite the institution's key decision-makers is one of the prerequisite conditions for embarking on an enterprise-level architecture work. The EA vision needs to be understood by the wider business to ensure buy-in and leadership from

administrative stakeholders. A clear EA vision ensures proper management of the various projects using the EA approach, without which the issues around the scope and relevance of the architectural descriptions are escalated. It is more difficult to implement EA using a bottom up approach than a top down approach in more academic institutions. The most viable approach in a neutral context would be a middle out approach, which should include ensuring that senior management buys in to the concept of EA and provides adequate support. While enlisting middle layer support and collaboration from middle managers and key stakeholders. In instances of adjustments to the institutional model, changes to the business goals, strategy, organisational structure and current architectures, such as, processes, information and technology may be necessary (Jonkers et al. 2006). In order to manage and control the development of the future architecture, there needs to be certain governance issues to be resolved. An IT governance structure makes business decisions on IT planning, while the EA governance, which helps the planning, design, and implementation of the business strategy supplements both the corporate and IT governance structures. The EA governance structure ensures that projects adhere to set goals and objectives, and that they support the overall strategic goal of the institution. A senior IT personnel, such as a Chief Information Officer (CIO), who liaises with the top-level decision makers may head the EA governance. The Head of Information Systems & Technology, who reports to the CIO, manages the EA team who manages the architecture work. The role of the CIO includes: (i) to act as a liaison in the strategic business planning process to ensure that there is a better understanding of the strategic objectives of the organisation, (ii) to ensure that the IS function is seen as important to achieving the strategic objective and thus, delivers value to the institution; (iii) to ensure that better IT investment decisions are considered to reduce risks and failure (iv) to ensure organisational competence and performance success overall (Benjamin et al. 1985; Lederer & Mendelow, 1987; Brumm, 1990; Kaarst-Brown, 2005; Shao et al. 2010). The corporate structures of universities are largely dominated by traditionalism and sectarianism, which influences the degree of change that is permitted within departments. Gaining support from senior management and heads of departments is identified as one of the major challenges to the adoption process. Unless the initiative has produced significant benefits to the institution, future adoption is challenging and hardly supported. Hence, EA practice remains at the departmental levels or within the IS department.

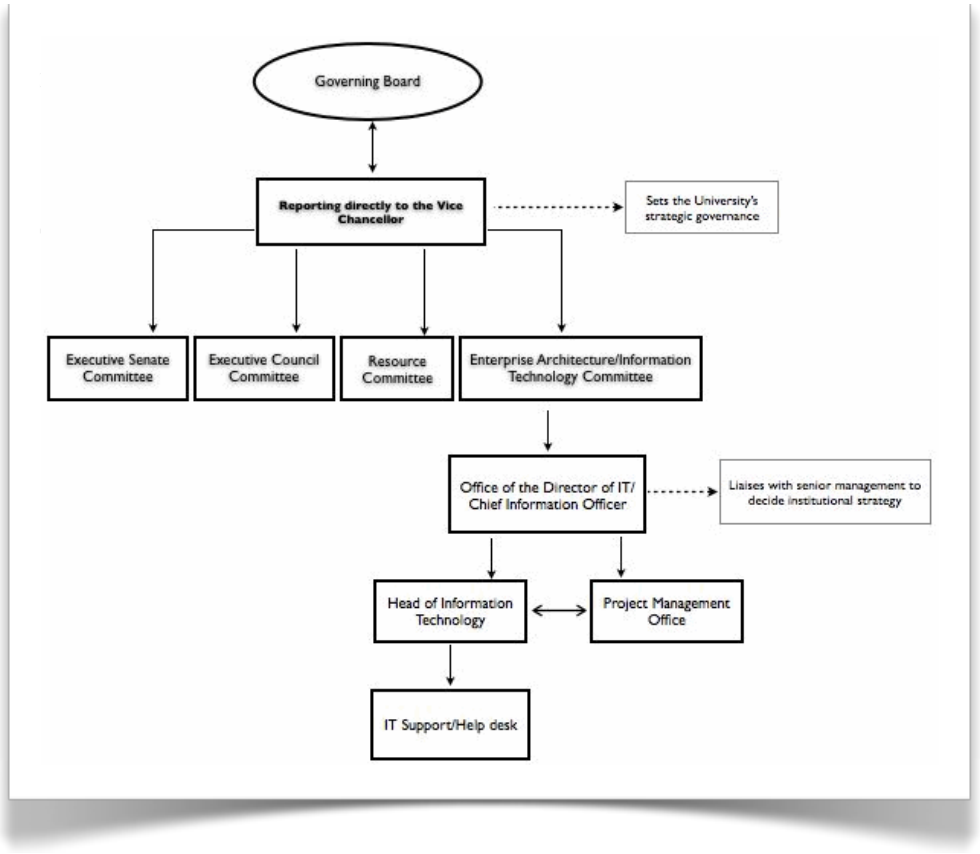

FIGURE 4.6. EXAMPLE CORPORATE UNIVERSITY GOVERNANCE STRUCTURE & EA.

4.5.2. EVALUATING EA WORK.

The lack of any measurement metric in assessing the EA initiative shows the low level of maturity of the EA discipline. They act as success indicators to identify performance improvement that translate to business value. Without proof of tangible benefits, there is low buy-in from senior management as sponsors of the EA initiative. Low EA maturity is closely related to the lack of performance measurement (Turner et al. 2009).

4.6. RESEARCH QUALITY AND ETHICS

It is become necessary for qualitative researchers to respond to issues of objectivity in interpreting research data, as opposed to scientific research that are performed in a purely unbiased and controlled environment (Kirk & Miller, 1986; Silverman, 1993).

4.6.1. REFLEXIVITY

A reflexive approach to this research takes into account the effect of the personality or presence of the researcher on what is being investigated. The strength of this research borders on the ability of the researcher to engage with the research setting, as a support staff and story editor for the workshops. This context provides the opportunity for the researcher to make meaning of the social actors and role of EA in the transformation journey. On the other hand, it is difficult to be completely detached, and neutral with the actors, their feelings and personal interpretations of their experiences. This researcher cannot claim neutrality and objectivity to the context of the study; instead the researcher acts as an intermediary between the outside world and that of the participants and becomes a visible and integral part of the community (Stanley & Wise, 1993; England, 1994; Brewer, 2000; Gibbs, 2007). This creates a sense that the research data is a representation of reality in the research process.

4.6.2. VALIDITY

Validity is the extent to which an account accurately represents the social phenomena to which it refers (Hammersley, 2002). The issue of validity is the ability to prove the integrity, character and quality of both the researcher and the study (Brinberg & McGrath, 1985; Kirk & Miller, 1986; Kvale, 1989; Gibbs, 2007; Silverman, 2010). The researcher ensures that the interviews and discussions with the participants were recorded, transcribed verbatim and validated before usage. This addresses the issue of *descriptive validity* (Wolcott, 1990a; Maxwell, 1992). The researcher takes into account the perceptions of the participants, to deduce '*emic*' meanings by interviewing the participants at their various institutions, observing their participation during the workshops and focus groups, and relating with them in other social contexts (Bohman, 1991). For the selected interviewees, their roles and direct involvement, the structure and semi-structured interviews, the research data gathered are trustworthy. The interviewees provided relevant answers to the researcher's questions and contributed additional information to the research. These facts are considered good alternatives for evaluating qualitative research data (Golafshani, 2003).

4.6.3. TRIANGULATION

One of the methods adopted by the researcher to validate research findings and confirm the reality of the situation as perceived by the participants, is the use of *data triangulation* (Mathison, 1988; Merriam, 1995; Denzin & Lincoln, 2005). Table 4.9. Shows a cross section of the Framework viewpoint on resources using three sources of data from the research case studies.

Case Study	Documented Report (See the JISC Early Adopter Study link in the appendix)	From Observation (See workshop list of attendees in appendix)	Interview Comment
KEAP	"We would suggest that an institution requires at least a dedicated person looking concentrating on EA, or a small team of people, depending on size of the institution and how loosely it is structured" (p.66)	Only one staff from the university was represented in two of the workshops cum focus groups held.	*"There were issues about both human and capital resource availability and allocation. They didn't think it was the most important thing to do with what resources were available at the moment." (MH)*
LEAP	"We need to address the issues around the lack of a specific EA resource – if the approach is to be embedded then it needs to have a 'home'. It would be helpful to better understand the minimum staffing level needed to do effective EA development" (p.52)	The institution has two business analysts attending the workshops but they had other job roles alongside their EA responsibilities.	*"For us, resourcing is one of the biggest problems; it's having people to do EA as a support function." (JT)*
LEAN EA	"Another internal challenge is to determine the kind of knowledge and expertise needed and associated resource requirement for this type of approach" (p.80)	Only one staff from the university was represented in two of the workshops.	*No interview transcript recorded.*
CAIRO	"The experience of this University, suggests that any such initiative will take at least 2 years to begin to show some effects … and require dedicated staff" (p.11)	Only one senior staff from the university was represented in two of the workshops.	*"The problem was … like getting the modelling software in, getting the team trained up to use it, getting a team trained up in TOGAF." (JK)*

TABLE 4.9. SAMPLE DATA TRIANGULATION OF CASE STUDIES.

4.7. CHAPTER SUMMARY

This chapter has presented the findings of each case study. The data was analysed using thematic analysis and broken down into basic, organising and global themes where each global theme represented a network or cluster of findings. Each thematic network was matched with the framework used to compare EA programs in this report. Two additional factors were considered during the analytical process. This chapter has discussed how the viewpoints used in comparing EA programs across these institutions and is instrumental in achieving success and sustainability of the programs. The subsequent chapter (Chapter 5 - Framework and Discussions) presents a pragmatic approach to the applicability of the research outcomes, which will enable continuity of EA in the HE sector. The discussion will focus on the issues presented in this chapter and how they will be useful and relevant to the EA community in UK universities.

CHAPTER FIVE: FRAMEWORK AND DISCUSSIONS

5.0. INTRODUCTION

Chapter Five provides discussions and implications of the EA *Support Structures*. The adopting institutions should consider four key issues that are likely to affect the implementation process during any proposed EA work. There is the need to reassess the core structures in the face of dramatic changes, such as, new government regulations, public funding, mergers and acquisition, and new opportunities. HE institutions should focus be on the ability to identify the trend of both internal and external customer needs (*sense*), and be aware of the business challenges that arise from them. They should also focus on building capabilities that enable quick business response (*respond*), rather than playing catch-up with business opportunities and technological advancement (Haeckel & Slywotzky, 1999; Voloudakis, 2005). The process of achieving a business or institutional goal may involve developing an EA strategy, where an EA strategy involves foreseeing the architectures most capable of fulfilling the changing business capabilities by implementing procedural approach to ensure the business goals are realised.

5.1. IMPLICATIONS OF INSTITUTIONAL SUPPORT IN EA

The EA *Support Structures* is designed to help the institution understand the support requirements for their business functions, processes, applications and systems, to create better understanding of interdependencies between them. In the face of emerging market opportunities that are currently available due to sector changes, both internal and external; there is the need to define a strategy that will explore market opportunities, assess the core structures, adapt where there is need to, and while acting accordingly. The processes that drive these change activities can be described as: *(i) Opportunity to Explore, (ii) Need to Assess, (iii) Requirements to Adapt, and (iv) Time to Act.*

(i) Opportunity to Explore

Current changes in the HE sector present opportunities for institutions to explore external potential market opportunities, i.e. Internationalisation of UK Higher Education. With the pressure on existing institutional operating models, many institutions are constrained with the difficulties in managing additional and external businesses. Institutions need to be agile in current sector changes without bringing ongoing operations to a halt.

(ii) Need to Assess

This aspect covers the process towards maximising market opportunities as they arise. This should be a methodical approach to assessing skills and training requirements for employees, the capacity and capability to expand systems functionalities. Typical changes, such as, an increased number in students enrollment may overburden existing systems capability, if they were not built to be robust and to accommodate frequent changes. Assessing institutional resources to support new operations resulting in growth and expansion is most often an afterthought by the decision makers.

(iii) Requirements to Adapt

Existing governance structures influence the change process to a substantial degree. IT Governance underpins any change initiative because it is instituted to empower and control the organisation's IT resources. With changing business models, institutions need to assess that the governance structure supports the proposed change or decide if the existing structures needs to the changed to suit the proposed changing operating model.

(iv) Time to Act

Positively reviewing potential factors that would make or break the proposed change will help institutions become more responsive and capable to expand into new opportunities.

Actions	**Structures to Review**	**Outcomes**
Explore	Sector environment	Opportunities
Assess	People and systems	Performance, new capabilities and resources
Adapt	Governance	Structural support
Act	Capability	Responsiveness

5.2. ELEMENTS OF THE SUPPORT STRUCTURES

There are the four EA *Support Structures* that can to be affected during any change initiative. The Support Structures represent the four key areas identified from the research findings that the institutions have experienced great difficulties at different stages of their EA work. The *Support Structures* ensure that new business changes are easily supported and aligned to fit strategic objectives and helps to ensure that capabilities can be built in these areas. The achievement of tactical goals can also be easily realised once there is a standard process to evaluate the current institutional position. Table 5.1. Presents the core structures and descriptions of their areas of impact. In every new business opportunities, the changes in these areas have an impact on the business. The effects could be the changing business models and people skills, culture, new processes, efficiencies of the technologies and the governance structure. Institutions would need to proactively consider these key areas to better respond to opportunities, build capabilities to respond for the future. The *Support Structures* are *(i) Governance (ii) People (iii) Processes (iv) Systems.*

5.2.1. GOVERNANCE

The governance structure supports the institution and provides that readiness to support changes. As institutions embrace the new business opportunities from the sector transformation, there are subsequent changes that impact on the current business models. A stable governance structure to will ensure that the management makes better decisions that will potentially affect other existing structures. Institutions would need to identify approaches that determine what governance structures to adopt; to adopt old structures, formalise new structures, or merge both existing and new practices to form a new governance structure that supports EA work. These decisions are applicable in areas, such as capital investment, infrastructure changes, business applications and information management. A good governance support structure would help to maintain the change processes before and after the projects. An effective governance support structure could also facilitate buy-in and senior management support for using the EA approach when the organisational roadmap is clearly articulated. Potential issues that will arise will include how to determine the

right amount of control over projects and how to determine those projects that align with an overall institutional vision.

5.2.2. PEOPLE

The support structure for people involvement identifies appropriate approaches to change management. There are many change management practices available, yet some institutions rarely subscribe to them in change programmes. The people support structure will help identify key individuals who can contribute to the EA work by identifying their needs and interests. On the other hand, a people support structure affords institution the ability to recognise staff schedule, skills and training required before engaging with the work. From the findings of this research, proper EA planning needs to be considered to minimise risk of failure especially while some institutions employ EA practices as ad hoc responsibilities because there are very few institutions that establish the role of Enterprise Architects. The difference in other private organisations is that EA work is supported by designated provision for an Enterprise Architecture team doing EA work, with the right skill sets. The resistance these institutions encountered was mostly internal and from the middle managers, who felt it was difficult to add more responsibilities to their staff and the need for them to learn new skills for the job. Two of the institutions had EA teams, which consisted of business analysts, project managers and modellers.

5.2.3. PROCESSES

It is necessary to understand the business process architecture and what systems depended on them to avoid these systems being pulled out of context. Having a systematic approach to business review increases the probability for EA success. Institutions need to reduce the complexities in business processes, making them more flexible so they can be easily adapted to suit different types of students in the HE context. For example, institutions should have standard automated processes across student contact points. This would ensure that institutions are able to reduce difficulties in cross-process integration in local and international initiatives. Building capabilities in process optimisation would imply ongoing support for EA work.

5.2.4. SYSTEMS

Institutions need to build simple and agile technology infrastructure that are robust and dynamic. There is the need for adequate levels of standardisation and integration patterns tailored to fit organisations. In the HE sector, institutions need to build system and technology capability by addressing the need for standardisation across departments. Building simple and agile infrastructure enables IS to provide required systems services, thereby eliminating the need for each department to have disparate IT investments and standards.

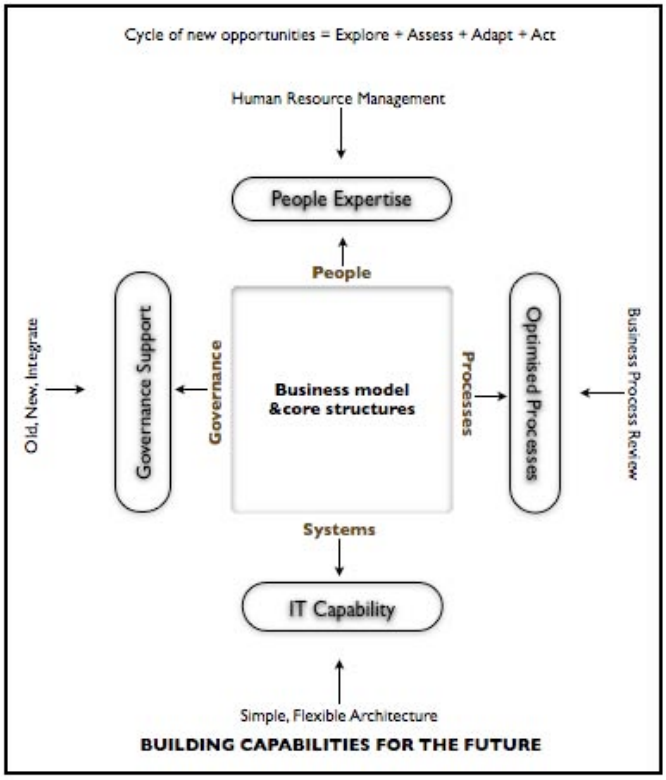

FIGURE 5.1. EA SUPPORT STRUCTURES.

5.3. REQUIREMENTS FOR EA CAPABILITY

To manage complexities in a system where demand exceeds supply would be difficult. Institutions should look to reduce differences of IS approaches by understanding systems capability and streamlining service routes. This would ensure that coordination and maintenance of outputs are more affordable. Coordination can be achieved by essentially rationing the diversity of technologies and providing integrated services. By doing this, the institution attenuates complexity of the technical environment. Institutions would then be able to respond quicker to service demand from one central control. This is an effective strategy, but not without its

costs. The strategy would demand that technologies would have to remain largely homogenous. Having a centralised system of IT management is a strategic step to improve the organisation for efficiency (Rickards, 2007). The system enhances the organisation's ability to respond uniformly to its environment, but only if IT strategy aligns with the business. This would ensure that all IT strategies are closely integrated and aligned with institutional strategy. Major benefits that can be achieved would include cost-effectiveness, better end-users' services, and economies of scale. Table 5.2. Presents the capability requirement and opportunities for planning by institutions in the four areas of the *Support Structures*.

Capability Components	**Capability Requirement**	**Organisational Planning**
Governance	People who understand the business as a whole, candidate areas for change and IT (software & hardware)	Identify capability gaps, Gather issues, provide EA principles, guidelines & implementation oversight
Processes	Specify improvement criteria, Identify & prioritize candidate processes.	New process design, redesign existing processes
People	New knowledge, new skills (technical, operational, etc.), business & IT analysis (meta-analysis skill)	Support for change in: culture, knowledge, competencies, support for implementing change
Systems	Assessment of existing systems infrastructure, identify potential updates	Workflow development, software development, hardware updates

TABLE 5.2. CAPABILITY ASSESSMENT TABLE.

5.4. APPROACHES TO EA

Table 5.3. Presents a descriptions of three types of approaches to adopting EA as; *top down*, *bottom up* and *middle out* approaches. These are common in other sector organisations and should be adopted if it fits the culture, values and needs of the specific HE institution. Overall, the EA work should be driven by a clear business vision and defined business context to attract stakeholder engagement and skills. The LeanEA project was initially faced with the enforcement of the EA principles being embedded institution-wide and not limited to the specific project. A typical example; The LeanEA the project was funded externally, but did not guarantee that EA would be readily embraced within the institution. The LeanEA project was seen as external to other institution-funded projects, hence the project team had to ensure it did not get

in the way of other projects. The MWE governance structure did not eventually oversee the EA approach. Institutional EA champions are few in numbers because they are restricted in their ability and jurisdiction to apply EA on larger projects or high priority projects. They need to prove the first the value of EA, and then make a business case to the senior management. In order to gain early support for the work, senior management would need to know about fundamental EA.

Approach	Architecture Vision	Governance	Implementation	Context
Top Down	Has clearly defined business strategy. Hence, the architecture work is driven by strategy and is highly prescriptive. Aims to develop top down solutions to meet business requirements.	Has a central decision making structure, hence a strong governance structures to ensure compliance. Establishes a relatively stable pace of change.	Some components of architecture may be standardised across the organisation and others decided at the business unit level. Strict use of standard industry frameworks.	Best suited to institutions that can drive large-scale efficiencies using its high level strategic objective down to other areas of the institution.
Bottom Up	Aims to connect with departmental systems to enable interoperability and information exchange. The architecture team seeks for small wins using EA under jurisdiction and low priority projects.	Decentralised decision-making structure. Has a weak governance structure, hence poor compliance measures.	Focusses on managing to connect the diverse structures within the institution instead of focussing on how to control the decision-making activities. Business units decide what solutions they want to implement and bear any associated risks.	Best suited to institutions that need quick results to address service provision, quality and small-scale efficiencies, especially in the application and technology structures.
Middle Out	Different departments have distinct and considerable autonomy over the EA required to support their specific individual business needs. Aims to enable interoperability and information exchange. Aims to reduce complexity and costs by having a limited set of standards.	Encourages innovation through a decentralised decision-making structure and independence at departmental levels. Largely decentralised decision-making structures. The architecture team does not seek to manage the entire enterprise but to enable each business unit to manage their architecture in coherence with the other departments.	Defines a small but rigidly enforced set of general, stable interface standards, semantic definitions or design specifications. Enables choice of standard solutions for the departments instead of being rule-bound. Enjoys the benefit of a resource-constrained environment. An environment of abundance does not enable emergence or collaboration. Rather, scarcity of resources drives emergence and collaboration.	Suitable for institutions where the departments are not under the direct control of a central EA team.

TABLE 5.3. APPROACHES TO EA.

5.5. A POTENTIAL FUTURE THAN A FAD

There is a widespread adoption of EA in UK HE institutions to plan IS change requirement led by the departments and business unit. The HE sector has experienced a growing interest and has seen an increased number of institutions adopting EA. Using the Gartner Hype Cycle to otherwise trace the progression of the EA activities reflects a timeline from early 2008 to the end of 2011. The Hype Cycle is a widely used industry model to determine the lifecycle of a technology adoption over a period (Fenn & Raskino, 2008). In 2008, there was the technology trigger phase (the introduction of EA by the JISC to HE institutions), through to year 2009, the JISC pilot began and the projects were used to assess the suitability of EA in the sector. There were issues of compatibility of the concept in the sector because of issues like: *(i) the term enterprise architecture, (ii) the ontology of EA, and (iii) the large and very prescriptive EA frameworks.* The initial challenge for institutions included understanding EA, its principles, and applications and getting cooperation from other key stakeholders. There was industry support offered by the Open Group and other HE consortium from the Netherlands and the United States. There was much support for institutions to understand and develop the required skills for the projects and JISC provided additional external support by hiring the services of an external consultant to manage the new-formed community. Four years later, EA began to gain recognition within the various institutions and the community grew to a record number of 40 institutions that were involved in discussions, workshops, a practice group and a foundations course for both business managers and non-technical staff. It is expected that in 2012, EA would remain in the 'Peak of Inflated Expectations' phase and then a decline in the enthusiasm would begin. Figure 5.2. Framework to show the activities so far of EA practices in the sector.

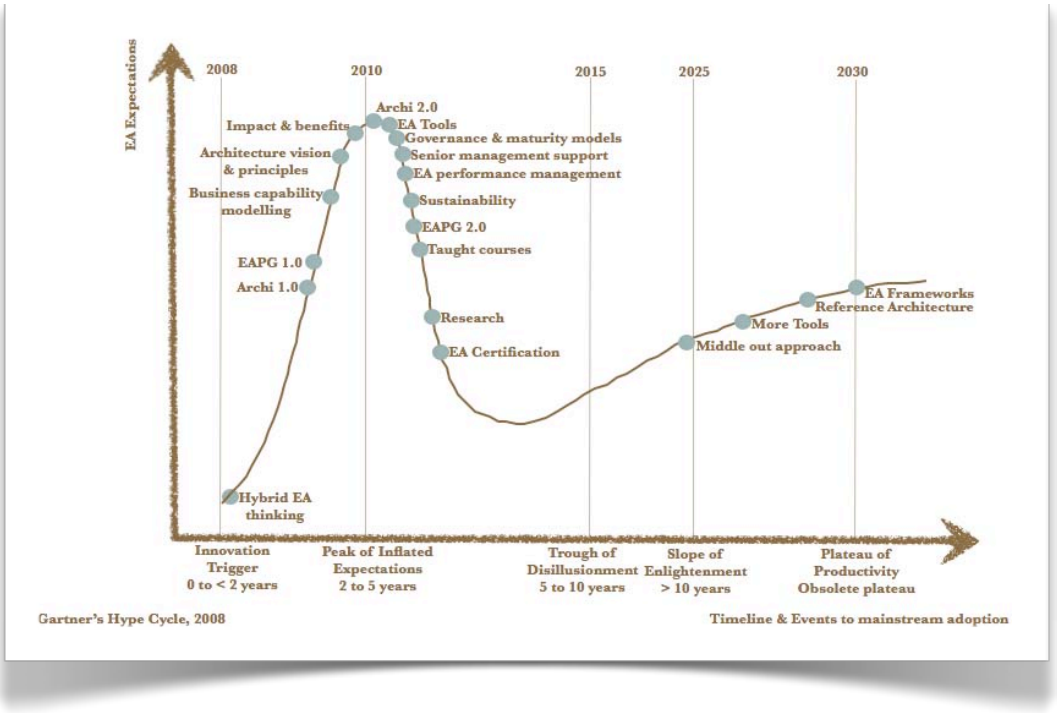

FIGURE 5.2. EA ROAD TO VALUE IN UK HE INSTITUTIONS.

An effective management of IS resources helps the IT business unit to become an asset and an enabler of the institutional strategy. In the book titled, '*Enterprise Architecture as Strategy*,' Ross et al. (2006) stated that many organisations follow predictable routes through developing their EA towards to maturity. These organisations have a higher percentage of local applications. They use less of enterprise systems and lack the ability to share or integrate data effectively within their business areas. On the other hand, HE institutions' need for systems connectivity is to eliminate business silos, reduce system complexities and build better IT capabilities. System complexity breeds poor business alignment with IT, lack of clear IT vision as perceived by management, lack of value creation from IT investment and subsequent business dissatisfaction with the state of affairs in the IT unit. From this point, there are three identifiable drivers for doing EA, which are process automation, IT efficiency and the need for integration (Ross et al. 2006). Then, organisations tend to transcend from operating in silos, to managing technology standards across the various business units. Although, standardising technology across the business may inhibit innovation but it reduces costs and encourages data sharing. Finally, organisations move from local systems-view to an enterprise-wide view. There are significant benefits from each of these distinct phases. Table 5.4. Highlights the types and areas of the organisation these benefits are visible. These benefits are applicable

to HE institutions because they are generated from the research data. The section below describes the business value of EA that relate to areas where institutions can build enhanced capabilities.

Value to the Institution	Value to IT	Value to the Sector
Ability to make better-informed decisions. Better visualisation of institutional capability - including IT resources. Better focus and optimisation for critical business functions/operations. Better business analysis & trained team.	Improved responsiveness to business requirements. Better visibility across processes & systems. Ability to maximise some level of control over IT solutions & decisions. Ability to manage & reuse of resources.	Improved compliance to regulations and data requirements. Improvements in the overall IT capability of institutions.

TABLE 5.4. SUMMARY OF EA BENEFITS TO HE INSTITUTIONS.

5.5.1. BUSINESS PROCESS IMPROVEMENT

The rate of changing business models, such as opportunities that arise for institutions to open international campuses abroad and the need to become more efficient in IT services, serve as internal business drivers to improve existing business processes. These processes need to be agile to adapt to changes as quickly as the strategy changes (Hammer, 1990). Institutions understand the need to review these processes and to identify areas for necessary improvements. EA will facilitate the use of process models to understand the dependencies and existing relationships between the processes, actors, systems and institutional functions (Davenport & Stoddard, 1994; Lankhorst et al. 2005).

5.5.2. APPLICATION PORTFOLIO MANAGEMENT

One of the drivers for EA adoption in institutions includes the need to manage the many applications to address data extraction and integration. Some of these applications are developed in-house, in the institutions, while others are bought off-the-shelf and are vendor-dependent. There are also applications acquired from other collaborating institutions that need to be integrated into the main application portfolio. The ability to understand the services that are generated by these

applications would the institution to reduce growing complexities and promote standardisation.

5.5.3. SIMPLER IT INFRASTRUCTURE

Institutions have also identified that there are technologies that have duplicated functionalities and that can be made redundant, which can free up space and improve cost efficiencies. There are many legacy and standalone systems that hold important data but are difficult for other systems to be connected. One of the pilot institutions moved from single system dependencies to single vendor-based platform to ensure easy integration. They experienced a reduction in staff time during upgrades and other integration needs. With the EA approach, standalone technologies can be gradually rationalised.

5.6. SUMMARY OF RECOMMENDATIONS FROM RESEARCH FINDINGS

The following are a set of recommendations arising from this study, which aims to provide practical solutions for adopting EA in institutions. These recommendations are practical approaches designed to support academic practitioners, to understand the connection between theory and practice. Thus, the research findings are more applicable to the HE institutions intending to use EA. This supports the fact that theoretical and practical knowledge are not mutually exclusive but can contribute to relevant knowledge for the development of the EA in the sector. This approach has been used in research and is considered as good practice for disseminating research findings (Hjort-Madsen, 2009). The seven recommendations presented in this section are based on best practices from EA adopters. Each recommendation is first presented followed by for its justification.

5.6.1. RECOMMENDATION ONE

Realistic and relevant EA deliverables should be clearly stated at the preliminary phase to ensure there are fewer disappointments.

What benefits will the institution get from EA? This question also covers one of the aims of the study, which looks to understand the drivers of EA in HE institutions. The EA benefits quadrant in Figure 8.6 shows four types of benefits institutions

identified during the interviews, such as better understanding of IT resources and ability to build IT synergies and solutions for business demands.

5.6.2. Recommendation Two

Don't attempt to do EA projects, but focus on doing institutional projects that use EA concepts.

Are EA concepts suited and adaptable in HE institutions? One of the concerns for EA adoption in HE institutions is the compatibility of EA concepts with institutional norms and values. The aim of EA is to ensure IT resources support the business vision and the two work in parallel. It would be wasteful to have IT resources and be unable to develop capabilities that meet business requirements. Business and IT should work in tandem. The study shows that institutions have successfully adopted EA on their own terms. They do not claim to do EA projects, but to do projects using EA. The concern should be more focused towards what it aims to solve than issues of its terminology. Concepts such as Service-Oriented Architecture and Shared Services are familiar in HE institutions, which shows that EA may be suited as well.

5.6.3. Recommendation Three

Choose the frameworks and modelling tools wisely but focus more attention on building relationships and fan base for doing EA.

Is EA too complex for HE institutions? Can institutions create the right environment for EA? In the research of EA in public sector governments, EA is usually complicated and becomes very technically focussed (Hjort-Madsen, 2009). The concern for HE institutions would be how to avoid being too technical with senior management and other collaborating departments. Using a modelling language such as ArchiMate provides that platform for an effective communication between business and IT. EA practitioners in HE institutions should spend a considerable amount of time building better relationships to broaden the champion base for doing EA. Less focus and emphasis should be given to the EA toolkit such as the frameworks and modelling tools.

5.6.4. Recommendation Four

Considering the scope of EA, choose to modularise the design and implementation phases following the EA framework.

How easy is it for all types of institutions to adopt EA? This borders on the issue of resourcing EA work and the ability for institutions to do piecemeal EA work. With the EA frameworks with specific reference to the Open Group EA framework; they are non restrictive and adaptable. Hence, smaller institutions can adopt EA on low-risk areas and on test-to-approve basis. Also, during the implementation phase, using external consultants is easier to kick-start the processes, while training is provided to the dedicated EA staff. The frameworks affords for modularisation during the implementation, which means that funds can be provided subsequently. This also suggests that EA can be adopted incrementally and more suitably as a long-term approach.

5.6.5. RECOMMENDATION FIVE

Adopt a measurement method to track the progress of the EA work and to benchmark with other EA initiatives.

How can institutions evaluate EA work? Is it sustainable? One of the findings of the study during the data collection process and the framework validation, the lack of a tool or method to evaluate EA work was highlighted. There are a few benchmarking methods that are available and in wide use. These tools helps to determine the maturity levels, activities and EA deliverables at both national and local levels. The lack of such tool clouds good judgement and decision-making. HE institutions are complex systems with much legality to conform. This requirement is by far one of the highest priorities in any EA work, and members of HE institutions are not easily persuaded by business fads. EA is sustainable if clear metrics are in place.

5.6.6. RECOMMENDATION SIX

Involve the business stakeholders at all levels and stages of the work.

What other supports structures are needed? In response to some of the issues identified in the study, there is the need for a form of support from senior management and other stakeholders. EA work requires thorough collaboration with all stakeholders. They should be involved at all stages and encourage more communication between business and IT. Once the work is left for the EA practitioners over an extended period, there is a high risk of it slipping into more technicalities. EA is about changing the culture and thinking of business people about IT. One respondent illustrates this clearly:

5.6.7. RECOMMENDATION SEVEN

Ensure there is a clear EA vision document that is approved at senior management levels, and all stakeholders' consents are received. Relate the EA vision with key areas of priorities on the senior management's agenda to get their attention. Strive to show immediate ROI on key institutional issues.

How can EA be successful within HE organisational structures? This needs to be dealt before dealing with other collaborations and support required from stakeholders. Hjort-Madsen (2009), in his report states that EA programmes are largely defined by organisational structures. This bears repetition as HE institutions are conservative organisations and administrative reforms are slow. From the study of EA as an innovative practice, HE institutions are grouped under the late adopter categories (Rogers, 1995). From practice, EA should be applicable in any organisational setup, but HE institutions do struggle with high bureaucratic and political agenda that may impede the time to adopt. One of the interviewees suggests an approach to embedding EA in existing institutional structures:

5.7. SUMMARY

This chapter has presented the role of EA as an accepted practice in managing change that affect the business and IS structures in institutions. The use of support structures is important to ensure a risk-proof adoption. Elements of the structures were discussed and a capability framework was designed to address some of the issues highlighted. This chapter addresses the third research question and the objectives to the impact and future of EA in the sector. Chapter Six provides the conclusions drawn from this study with a review of the initial research question, aims and objectives to review the findings. The researcher will also discuss the research limitations, contributions to knowledge and future work.

CHAPTER SIX: CONCLUSIONS AND FUTURE WORK

"The last revolution, the one before that, and the one before that, all failed because we made the same non-technological mistakes each time. It's time to notice those repeated errors, learn from them, and escape the cycle of failure"

(Ehrmann, 2000, p.40).

6.0. INTRODUCTION

This chapter is a summary account of the discussions presented in the previous chapters. The chapter will review the aims and objectives set out in this study to outline how they have been achieved and align with the expectations of this research. The theoretical and practical findings of this research contribute to Enterprise Architecture as a discipline by outlining the outcomes of the adoption in the UK HE sector. This chapter will further review the limitations of this study and proposed work for the future, such as, reviewing more case studies to draw up a more conclusive hypothesis.

6.1. REVIEW OF RESEARCH AIMS AND OBJECTIVES

This study motivation began as a review into the practice of EA adoption in UK HE universities. The JISC pilot programme for EA had four participating institutions, which were adopted as case study for this research. The research question investigated '*how Enterprise Architecture improves Business and IS planning in the HE sector'* with an aim to understand the application in areas of business and IS planning. One of the research objectives included identifying the motivation and drivers for EA adoption in each participating institution and the approach taken. Specifically, the first research aim addresses the motivation and drivers for EA adoption in UK HE universities. This aim is focused on reviewing issues in existing practices and the analysis identifies strong commitment from the university management members to transform students and administrative services using EA. The second research aim reviewed the processes each individual institution has taken of EA adoption. The study shows that the Joint Information Systems Committee is the main driving force for both educational and information management practices across the sector. The JISC EA pilot and Flexible Service Delivery (FSD) programmes have been the bedrock and drive for widespread discussion of EA across the sector. Among institutions, funding motivation is the drive for adopting EA, and this largely influences the scope of EA work each institution undertakes. A wider participation both from senior management and other departments within each institution is purported to determine the success of each pilot. The third aim of the study investigates the impact of the adoption in these institutions and the wider sector.

Rogers' theory of diffusion was used to analyse the set of factors that affect the adoption, which include size and structure of the institution.

The adaptation and use of the framework was used to analyse EA in each institution and compare with the others. The results show that each institution has instances of organisational, social, economic and analytical factors that affect the work. An extension of the framework identified pivotal factors that were consistently raised during the research data collection process. The analysis has employed a good level of rigour during the data collection phase validates the quality of data, analysis and interpretation of the findings, which represents a significant contribution towards the EA body of knowledge. The methodology chosen for the research has been altered severally, to ensure the processes were suitable to the research context. This process has ensured that the final output of the research reflected the experiences of participants and institutions.

6.2. Contributions to Knowledge in Theory and Practice

One of the main motivations of the study was to contribute to the rapid growth of a contemporary practice, with the intention of contributing to the existing body of knowledge by recounting the experiences of institutions in the UK HE sector. The goal of this research was to understand how institutions have adopted EA and develop a framework to improve the current approach in the sector. The contributions of the study are directed toward three types of audiences, namely for management of institutions, EA practitioners, and academic researchers.

6.2.1. Theoretical Contribution

This research contributes to an existing body of knowledge consisting of private and public sector organisations adopting EA. The strength of the research comes from the type (qualitative data) and quality (recorded and transcribed verbatim) of data used to make conclusive remarks in this chapter. The researcher has worked closely with the EA Practice Group in the sector for a significant period during this study. The analysis of EA adoption in the research case studies may bear some similarities with other organisations, businesses and communities in other sectors. Some of the findings have been presented in academic and industry-based conferences as well as

written papers that are published in IS conference proceedings where concepts were peer-reviewed.

The framework for evaluating EA work across government agencies in the public sector has been adapted for evaluating and comparing the work in this research. The framework was adapted accordingly to suit the context as additional elements were identified. The findings show the suitability of use of framework to the research context and EA to the HE community. The use of the research findings has been based on substantial empirical evidence into EA adoption in a public sector, particularly in the UK HE sector. This aspect represents one of the major contributions of this research because it represents the uniqueness of EA adoption process in these institutions. The framework will enable institutions and policy makers to have a better understanding of the effect of EA adoption for the sector as a whole, so that improvements can be made to successful future implementation strategies, the design of improved and suitable tools to support practitioners. Subsequently, the introduction and adoption process will help to address other issues in successful technology adoption in the sector. Hence, the research concludes that the findings from the use of the framework are applicable.

6.2.2. IMPLICATIONS FOR POLICY MAKERS

The findings from use of the framework highlight key issues that include that are affecting management decision processes and policy making for HE institutions. The adoption of EA has been highly influenced by policies, structures and actors in the institutions. HE institutions plan to improve IT governance and manage IS effectively so that technology resources become more efficient and cost effective. Institutions also need to manage the use of technology in a 21st learning environment as well as meet the dynamic needs of staff and students, while ensuring that IT objectives are better aligned with the institutional strategy. Thus, better policies are important to support both administrative and academic reforms, which can be supported with the appropriate management approaches.

6.2.3. IMPLICATIONS FOR PRACTITIONERS

This research findings will affect the work of EA working groups, consortium or other technical standards groups because the findings raises issues about ease of use of tools and costs associated with EA tools. The recommendations in chapter five of

this research informs the sector as a whole and creates opportunities for resolutions, such as, the identification of cost effective ways of adopting EA, meeting varied sector needs. As much as this research highlights some of the benefits using EA to improve institutional practices, the findings from the use of the framework suggest that HE institutions have distinct contexts and require different set of approaches to conducting EA work. Understanding this uniqueness will provide working groups and practitioners with possible solution to improve the practice of EA in public sector organisations.

6.2.4. Implications for Researchers

This research provides a better understanding of technology adoption, such as, EA in an HE context, and highlights potential issues that affect such adoption process including technical, economic and social factors. The initial survey conducted during the first data collection process shows the problems associated with using such techniques in a similar context, where the institutions were at the beginning stages of their adoption processes. On the other hand, the survey helped to identify institutions that had advanced in the process, which were used as selected case studies for this research. The case study approach presented better research opportunities for a more in-depth study and a more practical approach to support the various institutions in their process of adoption. This research largely contributes to a pragmatic approach for EA adoption in highly decentralised contexts, as well as being affected by other economic factors.

6.2.5. Framework Applicability

The framework was validated using data triangulation techniques in chapter four and used to evaluate the work of EA in another education context - the Brunei Ministry of Education. It was proven to be a useful and practical approach to review the EA programs in that context as the participants could easily identify similar areas they were having problems and decide on resolutions.

6.3. Research Limitations

As with any research, there are limitations that are inevitable in spite of the earlier risk assessments or other evaluation of potential constraints. The scope and

boundaries of the study was redefined, to reduce potential risks to the research schedule. Other associated limitations are outlined in the following section.

6.3.1. QUALITATIVE RESEARCH DATASET

Following the survey, there were only four institutions that were identified as potential case studies with sufficient data and the experience of adopting EA. This highlighted the constraints to use only these institutions for the study. Midway into conducting the interviews, one of the key actors in participating institutions resigned, and left the institution leaving the researcher with no ability to schedule further interviews in this institution. There were also very little longitudinal information that would support data gathered from these institutions; this facilitated the adoption of an observatory approach to the data collection process. As a result of the lack of academic publications on EA adoption in HE institutions, the researcher referenced cases studies from other government sector organisations. This restricted the researcher's ability to synthesise sufficient data from the four piloting institutions, but does not necessarily invalidate the research conclusions. Subsequently, there were increased interests in this research, as other institutions began to adopt EA. This positively affected the study but was not implemented because of time constraints.

6.3.2. GENERALISABLE FINDINGS

One of the findings of this research shows that there are clearly two distinct categories of universities that participated in the JISC EA pilot programme; two institutions are the Russell group or the pre-92 institutions, while the other two are labeled as the newer post-92 institutions. This categorisation is based on the premise of their date of establishment, management structure, size of institution, resource and financial capability. Arguably, the findings of this research shows that these factors largely influence the adoption process. On the other hand, the ability to generalise these results to the larger number of HE institutions in the UK should not be completely disregarded, but strengthened through future studies to evaluate EA adoption in other UK universities. A generalisation may be feasible if based on postulation instead of on number of HE institutions in the UK. The behaviours of the institutions in the study may be easily identifiable across different types of institutions. A larger, traditional and highly bureaucratic institution may have a higher tendency to be late adopters and laggards, while a smaller, newer and less

bureaucratic institution possess a higher tendency to manage the institution as a business, therefore, adept to adopting innovative business practices.

6.3.3. POST-FRAMEWORK VALIDATION

It may be useful to further test applicability of the framework to the wider HE sector, and probably at one of the upcoming workshops with a larger institutional representation. This framework may also be used to compare EA efforts between two different countries as well. Such validation would contribute substantially to the research findings and encourage generalisation. However, this study is reflective of the current understanding of EA adoption in UK HE institutions.

6.4. FUTURE WORK

There are opportunities to develop further the concepts of this study that are of interest both to the author and other interested parties. One area of focus is to adapt the framework further for each institution, taking into account their individual characteristics. This may involve a technique such as, action research or a more participatory research. The study would compare the elements of the framework with a real life scenario and implement identified resolutions in those situations. This would encourage the applicability of the framework and other ideas that may arise.

6.4.1. FUTURE PUBLICATIONS

One of the outcomes of this research includes the publication of a simplified version of how to adopt EA in an educational context titled *'Just Enough EA.'* This was published as a newsletter, with the aim of disseminating EA best practices from other institutions in a light-weight format. Other academic publications could be encouraged by gathering the experiences of other HE institutions from within and beyond the UK, to create a large dataset of a comparative report. The study would show the distinct approaches and issues other institutions encounter in the adoption process. The study would be submitted to peer-review journals for publication, thus contributing largely to the body of knowledge for the EA community.

6.4.2. DEVELOPING SPECIALISED TOOLS

As EA practices progress at a relatively steady pace within the institutions, the use of large and very prescriptive EA tools, such as, the Open Group Architectural Framework (TOGAF) and locked-in vendor modelling tools, other open source communities and HE standards bodies could focus on sector specific tools. The tools should address issues on ease of use, integration and cost into its development. The development of sector-based reference architectures may also be considered to support institutions in building models and structures that are reusable across the sector.

6.5. SUMMARY

In conclusion, the aims and objectives of this research in chapter one have been successfully addressed, which included the need to understand the motivation for EA adoption in UK Universities and to identify the impacts in transforming traditional IS planning techniques. Real and practical scenarios that have afforded the researcher access to a rich source of information for the targeted audience have supported the empirical research. The adaptation and use of the framework to compare the efforts of four HE institutions have proved an invaluable experience in understanding the factors that affect EA adoption in the sector. The limitations of the research included the small number of universities used initially for data collection could not be surpassed, adequate data largely through interviews, focus groups and observations have provided a rich source of information. As part of the outcomes of the study, there has been a publication of a series of interviews conducted during the data collection phase that highlights experiences of the adopters and practitioners of EA in HE institutions. Thus, institutions need to be fully supported in the next coming years, as EA has an impact on IS planning, although there are only very few institutions adopting EA institution-wide. *The final proposition from this research is that, the structure and characteristics of any social system largely influences the adoption of innovation, to success or failure.*

APPENDIX A

Appendix A contains snapshots of interview surveys and semi-structured interviews, transcripts of conducted interviews and coding templates.

Interview Schedule

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The material detailed above has been removed from this electronic copy due to issues of confidentiality.

Interview Questions

Perspectives of EA	**Interview themes**
What is your perception of the role of the EA initiative within HEIs?	Definition of EA in HEIs
Identifying EA Stakeholders	
What are the reasons for introducing EA (What are the drivers of EA in your institution?) and how is the decision to adopt EA made? What amount of resources do you really need to carry out EA? Would you have (**already or to be trained**) capable FTE staff to undertake EA work?	To identify the group of **stakeholders**/policy makers. Staff Resources
EA focus and Priorities	
What is the current EA **priority and focus** (technical, data, information, process improvement, integration, standardisation and/or the key processes and capability that will be affected by the EA effort)? Are these activities conducted as a whole roll-out programme or incrementally?	To identify EA activities, priorities and strategy.
Senior Management Support for EA Innovation	**Theme**
What form/level of support and commitment do you get from senior management?	Senior management support
How is the EA program relevant/aligned to the Institution's Strategic plan?	Business and IT alignment
Managing Change	**Themes**
How do users/staff react to using EA (**methodologies, tools, frameworks, standards, principles and artefacts**)? for the institution? How do you support such disruptions of innovative technologies/techniques such as EA? How do you support the type of change (**economic necessity or developing organisational capabilities**) EA brings to the Institution?	Change management/Innovation diffusion
Identifying IT Governance	
How do you standardise systems and processes in a decentralised institution?	IT governance
EA Achieved Benefits	
What value does an EA-related activity deliver to the institution? How do you think EA adoption improves IT planning and support administrative transformation in the institution? How do you justify EA spendings?	Benefits
EA Collaborations	
What form of collaborations (institutions or industry) influences your work thus far?	External Collaborations
Implementation Strategies	
What adjustments did you have to make before you could implement EA in your institution?	Institutional adjustments
What are the big challenges in EA?	Implementation
What tools do you use to support your EA activities and how are they chosen?	Methodologies (tools, frameworks, vendors, outsourcing)
What lessons have been learnt and how would you improve on future EA work?	Lessons learnt and recommendations

Sample Interview Transcript (Not real name of the actual interviewee)

Carl	The project we ran was from the start of 2008 to end of 2008.
Interviewer	EA definition
Carl – R1	Am more interested in doing these things in practice. The background for what we were doing. Essentially our projects were slightly different from so many others because we're looking at a particular domain within the particular activity within the institution because we're responsible for stuff to support researching than the institution because we're responsible for stuff to support the researchers in the institution eventually. And what our observation was, there was a lot of disparate initiatives going on over the college, doing this stuff and the other for researchers. But they were all stuff going on independently of each other. They weren't really connected up. So what I understood EA was really an approach which will enable us to take an architectural view of all these activities with a view to, looking at the bigger picture and finding out how these various activities linked in within that bigger picture. It wasn't the whole institution. It was really things that were related to research. So our centre for research and our thing is to do stuff that support researchers and how researchers do collaborative projects of various natures. So we have nothing to do with things like whether the student records systems or anything like that. that's all for other people. So that's why I said it was slightly different than it was looking really from one aspect.
Interviewer	Institutional bigger program
Carl – R2	**Yes, that was the connected campus thing. Originally when we started off, our idea was that we would demonstrate the usefulness of doing the projects within our particular area and with a view to try to push out the idea and get it adopted elsewhere within the institution or higher level if you like. He call to meet that bigger program was quite right for that because it was all to do with connecting up all these different initiatives and making sure that formal coherence hold. We didn't have a lot of joy in getting... sometimes a bit non-receptive in new ideas, so we didn't have a lot of joy in getting them really to take this up in a short frame.**
Interviewer	Current status
Carl – R3	**We're still, some people disagree, they say EA, but it is to me, we're still looking at the entire, but just particular aspect of it. We're still carrying on these approaches in a pragmatic and practical way within the sort of areas that are under our jurisdiction. That doesn't just mean doing research, it's got things like research information as well. So we're carrying on doing it in our domain. The idea would be, we're still hoping that we will demonstrate the utility approaches and other people will take them up. Which was our original plan. That which didn't come to fruition during the year of that project. So we're still trying to be drivers for it (EA) within the institution. Some of the other cases, the decision was taken from the top that 'we would do this' sort of approach. In our case, it didn't. We are responsible for certain areas and we thought this approaches would be useful. And the aim was to demonstrate it to utility and get it taken up at the high level. A matter in that project we didn't have much joy with because they're all too busy with other things and they were a bit, sometimes a bit conservative when it comes to new ideas. But we're still carrying on in our area which is quite large and wide spread and encouraging extended take-up within the institution for these approaches because already this idea obviously is done at an enterprise-wide level. I don't think it makes sense to do it at the sort of level we're doing it at. I think of it as guerrilla EA, so we're doing it, not centrally until we some time we demonstrate to utility get it worked it. That's why we're doing things on the low slightly like partially but to get things accepted and then taking up more globally.** The keap project which is the one you got the report from, the presentation by SM, was like a follow-up activities. We're involved in lots of individual projects within the institution with different researchers and with administrative people who are researchers, and people who are involved in research support. What simon's been doing is trying to map into a bigger picture so that there's certain amount of abstraction for particular sort of needs and requirements. Research is quite unusual, different researchers do want to do, different researchers want o do very different things at one level but on the other hand, there's a lot of quite, if you look at that a bit more abstractly because a lot of general things they want to do. Our approach is to look at the specific requirements and abstract out and produce a more generic architecture from that. From the outside of it, there will always be very specific things, but we've abstracted the common principles and things, requirements.
Interviewer	Issues, challenges
Carl – R4	**I think it was hard to convince them it was a worthwhile thing to do and they think that seem to be, 'oh, we've always done things like things even though they know it's a change, which I thought was a bit daft. They had this program which was all predicated on the fact that we are changing how things were done. Also, I think we were, since we were been off the side, we were viewed by some people in a sort of central library systems area, let's say as a danger, we were doing something new and a bit wacky from their point of view and they didn't sort of, for that reason, maybe they didn't say yes 'that's a great idea'. We're a bit conservative, a bit reluctant to do things in a new way was I suppose the best way.**
Interviewer	Sectarian views?
Carl – R5	**No, it's individual views. It wasn't an institutional position. I think it's more of a matter of individuals within ISS, ISS is a combination of the library and IT. They do all that sort of thing including all the necessary systems. So they're the people that are running the connected campus program.**
Interviewer	Selling EA effectively – pitching EA
Carl – R6	**I do. I think that in our case, the approach we're now is sort of demonstrate to utilities rather than just say, yeas, we think it is a great idea and explain why. So a practical demonstration would have been okay. But I don't want to go on about individuals because it's an organisation and a matter of political conflicts between them. People who had to make the decisions didn't think it was a necessarily an important route to down at that particular time. Some people did but not the right people to get the decision taken to do it.**
Interviewer	Institutional drivers
Carl – R7	In creating a more effective environment in which to work and study because from my point of view we were only interested in researchers and we're interested in helping them do their research in more effective way by building an architecture development environments whereby in which they can work more effectively. So it's not just bringing together. I mean we would want o save money too but I don't think as being such as much because the saving money is making life better for researchers. But off course that does save money because if you make life better for researchers, then more of their time and research bodies would be spent doing research rather than worrying doing other things because moving through one systems to another uses a bit of their time, obviously that's wasted money. Then they've got more work done for the money they had.
Interviewer	Not cost savings
Carl – R8	It may be on the top of the minds of some people in the institution but for me am more interested in improving quality rather than directly saving money.
Interviewer	Bottom-up approach
Carl – R9	Yes. It's not that they said it was rubbish, it was more that, 'we've got more important things to worry about at the moment' sort of thing rather than anything else. **I suppose it's resources to the extent of there're most important things to do with what resources they had**
Interviewer	EA resources
Carl – R10	**I think it's good to have people, at least someone dedicated to it because, if you're doing it at an institutional level, I think you need a team dedicated to it to be honest not just a person doing bits of it here and there. We're not doing for the whole institution. If we were, I definitely want to say, I wouldn't like to quantify now because we haven't such a team, at least it would be a team at least dedicated to it. I think you need people to focus on it and they need to be given the ear of important people who have the authority to go and speak to various important folks across the institution. I wouldn't try to get people. Though I wouldn't them doing the EA and doing some of the day job at the same time. I had a separate group whose it was to liaise with these different stakeholders of the institution and had the ear of people quite high up. That's what I mean I mean by having them dedicated.**
Interviewer	External consultancy
Carl – R11	I wouldn't. It's just external consultancy to be honest. Spend a lot of money without doing very much. That's just my cynicism perhaps. The answer is no except consultancy to do a very specific well-defined task maybe. I certainly wouldn't get them to do anything open-ended like go a figure out EA in the institution. You might as well write my blank check. For well-defined task, I'll certainly get experts in to do training and to advice your but I wouldn't sort of just say, go here and do EA for the institution. Even that I'll be pretty careful about who they were. Consultants don't have such a big stake in the outcome to some extent and it's not the same as actually working and being part of the team.
Interviewer	Functional areas institutionally
Carl – R12	Out of the research aspect, it's not that of my responsibility so I couldn't really say.
Interviewer	IT governance structure
Carl – R13	I can look up the structure for you...(NTS: email mark for brief of governance structure) We're probably not so much involved in a central governance kind of thing
Interviewer	EA improves IT planning compared to traditional IS planning.
Carl – R14	I think it's different because it's taking a step back and it at looking at architecture not in terms of just IT but it's a whole load of other stuff as well. I think that would be the important thing. Showed it to some of the more techie people here, they think it's some sort of designed architecture in the sense of designing a system architecture here. It's more than that. It's an architecture of the institution. So it includes some other things as well that aren't just system type. I say that was the difference.
Interviewer	Implementation issues
Carl – R15	**We do have difficulties when we do have to interact with people and systems outside our domain obviously we have to deal with people in other areas of the institution. That's difficult for me. Obviously to implement that processes, we do have to interact with other sorts of departments and their systems as well. So it's not entirely within our control I guess. We have to interact with people who are doing something else. And because we're funded entirely by projects, if we were interested in normal IT departments, we wouldn't be funded by projects, we'll be funded by the institution. But that centre is actually funded more or less entirely by projects other from JISC or research councils. So we don't have specific funding for doing EA. It's the bid from the fsd program that's not actually much of the way it's staffed, so we sort of sliced bits off of the projects essentially to do it because it's all related to different other projects. So about the resources, we could do with more resources specifically to do that.** **It's pretty (difficult) because of the way we're funded as well. So we have to keep getting new projects and to keep up that momentum because if that project dried up completely we obviously got nothing to do.**
Interviewer	Fsd bids
Carl – R16	We had a couple of (bids). We put in two proposals, we won one of them. So that's something else we could do. Actually we're one of the planned demonstrators.
Interviewer	Build up your portfolio
Carl – R17	Yes, part of our interaction would be the essential part, business cases... for the new projects, we would actually be liaising closely with researchers because there are people in the central IT who are very interested in the idea of having an institutional cloud and they've got sorts of use cases for this as well, this project. So it's quite likely that we've interested them, so it's quite likely that something that would end up being rolled out and taken over by them as a production service later if we can provide different business case for it.
Interviewer	EA fad or future?
Carl – R18	Am not really good at predicting the future. Am quite cynical about these things. When I first came across it, there was so much waffle and jargons involved and I thought it was a waste of time. But I think once you, it's a matter of looking at it pragmatically and not getting uptight about all the jargons and all the waffle and all the people who do consultancy for their own sake of doing consultancy. I think it is useful if you take the project the pragmatic way that it may evolve into something else and it may evolve over the years. I think that sort of the idea of looking at things, the enterprise as a whole and the holistic thing and trying to architect all the different components such as IT things but other things of the institution as well is very important. So, yeah, I think it will survive in some form but I think it needs to be approached pragmatically rather than of projects that aren't theoretical fashion.
Interviewer	EA as institutional initiative
Carl – R19	It depends on how much money they have. I think it's only with the health. But I think it's a good idea. I don't know if we would have thought about doing EA, to be honest. Certainly I think it was a definite stimulus to do it.
Interviewer	Lessons learnt
Carl – R20	**Do it at an institutional level rather than the sort of slightly partial way we're doing here. I think it's very important to support things to get buy-in from the appropriate people and the authority. If you get the buy-in from talking to other people, some people may think you're sort of threading on their toes, or nestling on their patch. So you need to have people who are authorised at the reasonably high levels to actually do this. I mean, that's pretty the most important thing. So it's buy-in at the sufficiently high level and where you're given authority.** It is quite hard work. Without some tangible benefits it's quite hard to explain. I suppose that's what one of the advantages of the JISC thing because you could at least try all things out, it might not have worked in our case but in the other cases, I think it did work quite well and demonstrate the effectiveness of it in that fashion. But it's very important to get the buy-in and the buy-in from someone who's in authority is important to make things happen. Because in a big organisation, there's bound to be some people who are obstructive as you can imagine.
Interviewer	Would your bid to the institution be successful?

Project Acronym: KEAP
Version: 2.0
Contact: Mark Hedges
Date: 07/Mar/2009

JISC Final Report

Title Page

Project Name: KCL Enterprise Architecture Project (KEAP)
Author: Mark Hedges
Contact: Mark Hedges
Date: 07-Mar-2009

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Acknowledgements

This project was funded by JISC as part of the Enterprise Architecture Pilot programme. We would like to thank the programme manager Myles Danson, the other project teams in the programme, the TechWatch team, and Harmen van den Berg of BiZZdesign for their assistance during the project. We would particularly like to thank Bill Olivier for his insights and several very useful discussions.

Executive Summary

The KEAP project formed part of a larger project at King's College London to develop a research infrastructure for the College. The aim of KEAP itself was to evaluate the utility of an Enterprise Architecture approach to this larger project, looking specifically at the research domain in the institution. To this end, the project team applied the TOGAF framework, and in particular the TOGAF Architecture Development Method (ADM), to the domain.

The project team's conclusions about TOGAF were somewhat ambivalent. On the one hand, we felt that it was too heavyweight, and at the same time too generic; on the other hand, if it was used in a lightweight fashion, it proved useful as a broad framework and vocabulary for representing our architectural work. Subsequent work with the Archimate standard was more promising, although more practical evaluation is required. Overall, however, we concluded that the EA approach can be a fruitful one.

Note: the information in this document is in many respects a summary of the Case Study deliverable, which should be consulted if more detail is required.

Background

In support of the College's Strategic Plan for 2006-2016, Information Systems and Services (ISS) at King's College London (KCL) is carrying out a five-year programme for the development of the College's Information Services (IS) and Information Technology (IT) infrastructure, called the "Connected Campus" (CC), which aims to create a comprehensive framework for the support of institution-wide teaching, learning, research and administration. The vision of the CC is to deliver an

Sample Snapshot of Coding Template

Line no.	Codes	Issues discussed	Themes identified
	Definition		The different universities have different EA focus and this boost my research reports. Though EA has technical bit with it but it's kind of a management tool
	Strategic	Perspectives	Yeah, If you're looking at it strategically,
	Tool	View	EA is seen as a strategic tool
	management interoperability	Perspectives Different systems Data	you're looking at the management of data and the interoperability of the different systems
	opportunities	Opens up Brings	but that then opens so many doors
			(management and interoperability brings opportunities)
		Data Capture Different	in terms of the data that you need, the data that you're therefore capturing and how you can use that to inform different parts of operations within the organisation and that's been a clear example with the way that the CelCat system has developed which is designed as a timetable system and by having being able to capture data from different areas of the organisation
	information	Inform organisation usage	use of the celcat system is a typical example of how data is captured and used to inform different parts of the organisation.
	understanding	Comprehension Organisation Architecture of the organisation	and this is without us really understanding the EA of the organisation.

Line no.	Codes	Issues discussed	Themes identified
		Understanding the organisation Understanding data properly Informed departments Understanding operations Understanding effects	Understanding the EA of the organisation means understanding and managing data properly and getting departments informed of institution-wide operations. It entails understanding how each department works and the effects on others.
	Lack	Lack understanding	Currently, without EA, there is lack of this understanding.
	Sophistication	Using data Various systems Application	So this is using the data in the various systems in quite a sophisticated way.
			Data management brings sophistication to the organisation
	Opportunities	Amount Architecture of the organisation	But am sure that there are so many more opportunities if we understand the architecture across the organisation.
			Positive and firm belief that EA would help manage institutional data and surface more opportunities and avenues to explore.
		Event Link Different data	But what is actually happened here is that the data that is released because we're linking different data from different places,
		Different sources	Currently linking different data from different places/sources
	Benefits	View Clarity	just telling completely, its given clarity

APPENDIX B

Appendix B contains snapshots of workshop and focus group reports including a final report for the project.

Sample Workshop/Focus Group Agenda and Topic Guide

Pages 120 -121

The material detailed above has been removed from this electronic copy due to issues of confidentiality.

APPENDIX B

Appendix B contains snapshots of workshop and focus group reports including a final report for the project.

Workshop/Focus Group Attendance (Roles and institutions)

Pages 120 -121

The material detailed above has been removed from this electronic copy due to issues of confidentiality.

Sample Meeting Report

Flexible Service Delivery Programme

Enterprise Architecture Practice Group Workshop 3: EA Impact

21 & 22 June 2010 Maple House, Birmingham

1. Background

This was the third EA Practice group workshop – the fourth including the London event in April 2009. It brought together IT and business managers and specialists from the UK HE & FE communities to learn and share experience and questions on getting started in Enterprise Architecture as a way to enable and support major change through ICT in their institutions – 'learning by doing together'. It was also the first where we spent two days largely on EA, and experimented with separate practitioner and management streams

33 people registered to attend this time, from 19 EA adopter organisations (including consortia and one local authority), 5 attending for the first time.

These notes are intended to add to the working knowledge and shared experience for EA adopters. We hope they will be useful to the wider group of EA followers, who are encouraged to contact anyone who took part to seek explanation, clarification and enlightenment! The notes may be quoted freely so long as the source is acknowledged and will also be added to the JISC EA knowledge base.

Presentations can be accessed at:

Actions are highlighted thus.

2. Day 1: Welcome and introduction

David welcomed and thanked all attendees for making the effort to join the 2 days discussions. "Learning by doing together" is the motto for the Practice Group, encouraging participants to work together and share their experiences and the theme for this workshop was 'EA Impact' – identifying real value. This has always been a key element of the JISC approach to EA, now even more important in the light of reduced funding and other major changes

Adopting EA is a challenging task and in terms of timeline three years would be an industry standard for individuals and organisations to fully get up to speed with the topic. There is evidence that our approach can reduce the time to get started to nearer six months and the aim is to further reduce the initial learning curve with the help of the 'EA Foundations' program starting in September/October 2010. It was suggested that the JISC approach provides a potentially 'disruptive' model of EA adoption that others could learn from.

David then moved to talk about the brief history on the adoption of EA which started 2.5 years ago and the idea of the 'road to value'. The pioneers of course were LJMU, Kings College London, Cardiff and Roehampton and it was interesting to have a participant from Manchester City Council – a different arm of the public sector. Main presentation points were:

- FSD program's initial investment of £800K, now £1.4m and a further 15 projects for call 2
- EA and the its effect on the process of change
- Institutions that are not successful in the bids will be encouraged to take part in the EA Practice group, and funding may be available for travel and training
- We should use the '3 E's to measure success:

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Support Theme Network

Global theme		
Definition for Support: to enable to function or act; to approve of and encourage Institutional Support: Institutional support includes senior management support (allocation of budget and personnel resources) and stakeholder commitment to the program.		
Global theme	Organising theme	Basic theme
Institutional Support	Size	Team Amount Influential People Business People
	Category	Delivery Support Project Support Process Support (3) Technical Support Technology Support Operational Support Consultancy Support
	Recipients	Need to support Faculties Sector Support for Universities (3) Student User Support Need to support IT Support for EA Adopters
	Need	Need for more supportive IT Role Lack of supporting activities Non existent support for Processes Need for Support Function (2) Lack of Support
Global theme	Organising theme	Basic theme
Institutional Support	Tools	ArchiMate Supports Conversations ArchiMate provides understanding ArchiMate describes the relationships/dependencies between systems and processes
	Benefits	Helpful Support and Advise Capability of systems, Growth Flexibility Identify the capacity Need for systems overview Faster adoption Reference Architecture Change Management Support Willingness to Change
Global theme	Organising theme	Basic theme
Institutional Support	Responsibility	Identifying the business need and support requirement Support Function ensures more institutional flexibility Good support Function consist of Networking, Good Relationships, Results, Support Change Programmes Support Governance Model Support Conversations Support Innovativeness Capture the learning
	Difficulty	Resourcing University Culture Politics Making a good business case Gaining Senior Management Support (3) Lack of Motivation/Interest Fit within Management Structure Vulnerability of support roles Time requirement Cost

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